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ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Improved Wall Radial Drill.

An improved form of a machine which, though comparatively little used in this country, has merits which entitle it to greater consideration than it usually receives from shop owners, is illustrated herewith. It is adapted to be fastened to a wall or to a pair of upright iron beams, the framework which fastens to the wall being made to cover an unusually large area.

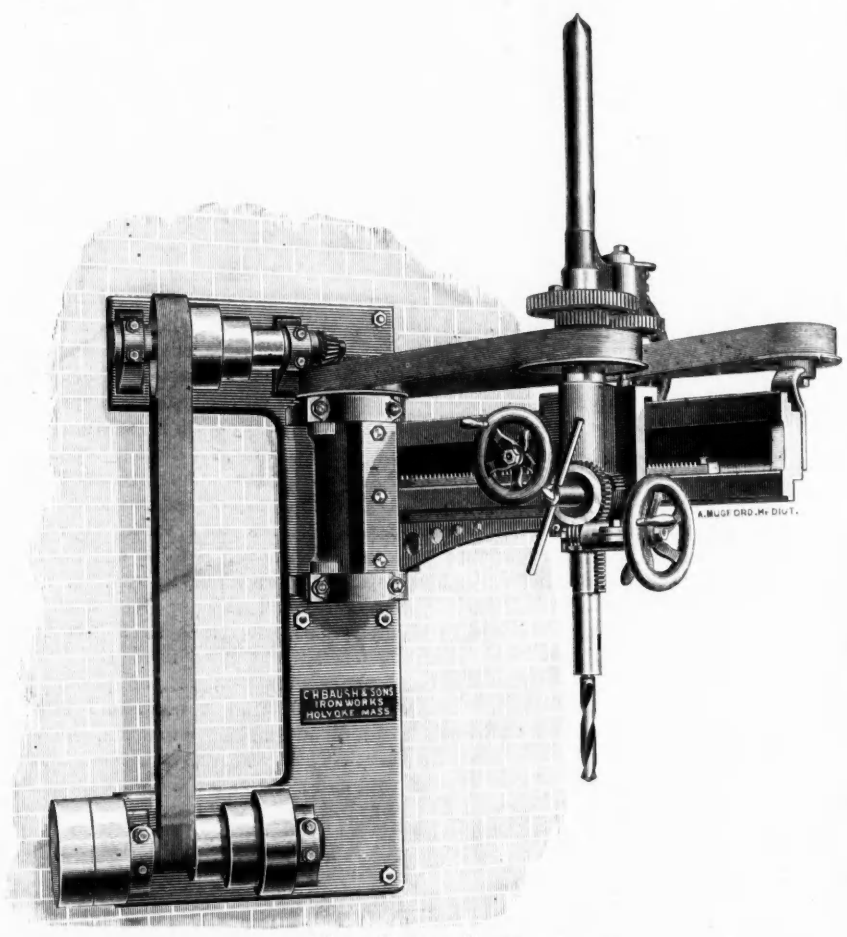
The machine is heavily belted, and the back gears placed upon the drill spindle where their action is direct and least liable to produce vibration or chattering in doing heavy work. The saddle is operated by a hand-wheel with rack and pinion; the hand-wheel for this, and the one for running the spindle up and down, being conveniently located with reference to each other. The spindle is balanced and has a quick-return motion.

A large table, not shown in the illustration, goes with the machine, and to this, work can be fastened and set at any desired angle. The arm can be swung to any desired position with entire ease and rigidly clamped.

The machine shown will drill to the center of eight feet.

When not in use the arm can be swung round against the wall, out of the way.

The makers are C. H. Baush & Sons, Holyoke, Mass.



WALL RADIAL DRILL.

The Hot Blast System of Warming Factories, Mills and Workshops.

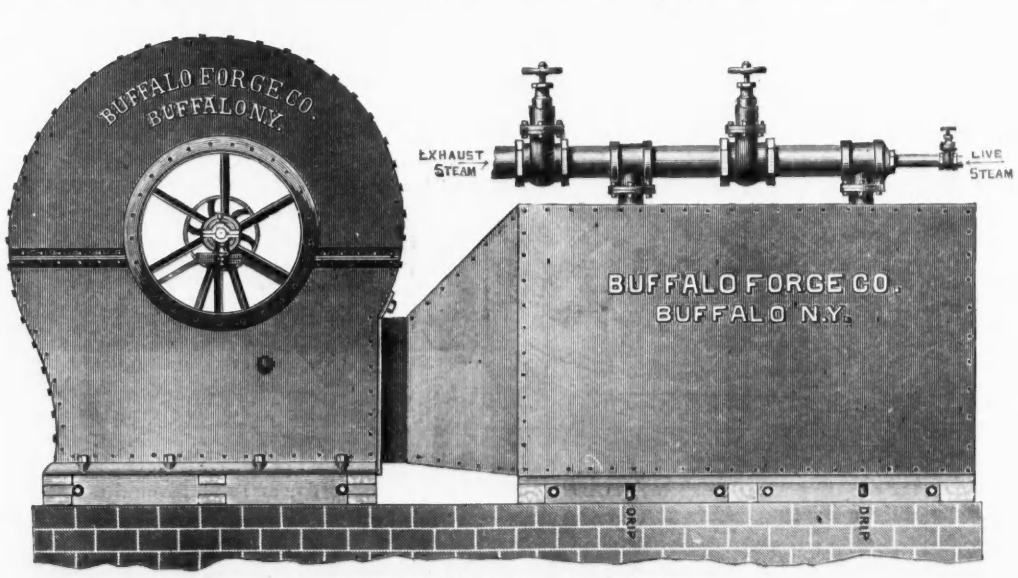
The system of heating factories and large buildings by mechanical circulation of hot air, known as the indirect radiation or hot blast system has of late years been attracting the attention of owners and builders, either as the result of their own observation, or by the endorsement of authorities in such matters who have instituted comparisons which have satisfied them of its advantages as compared with any other method of heating large buildings now employed.

We present herewith a cut of the apparatus, also diagrams in ground plan and elevation (page 2), showing the practical application of this system to a machine shop and foundry in St. Louis, Mo.

It will be seen that the apparatus consists of a blower and heater combined. The steam is conducted through the pipes of the heater, through which the air is blown, and the heated air is then passed through ducts to all parts of the building.

Though made of different proportions, according to the service required of them, the particular heater illustrated contains 3,000 feet of pipe, and is divided into two sections entirely separate from each other, so that by closing the central valve, shown on top of the heater, exhaust steam can be used in the section through which the air first passes, and live steam in the other section. Or, when it is desirable to do so, either exhaust or live steam can be used in both sections, by opening the central valve and closing one or the other of the outer ones. They are sometimes made with three or four sections, so that the supply of steam may be regulated to meet greater variations in the requirements.

The opinion seems to be quite general amongst those who have given attention to these matters, that the hot blast system costs less, both in the items of first cost and running expenses, than the ordinary method of heating, as it requires a reduced area of heating surface, and is peculiarly adapted to the use of exhaust steam, so that, in a majority of factories where large engines are used, only a small amount of live steam is required, it being possible, except in the severest weather, to heat the building with exhaust steam from the engine alone. Moreover, the different rooms, though perhaps requiring different degrees of temperature, are heated uniformly in every part, as the warm air is forced to the most remote corners in every part of the building—differing in this regard from the ordinary method of steam heating by direct radiation, which, while producing a comfortable and often an oppressive inert heat in the immediate vicinity of a radiator, communicates warmth to the surrounding air slowly, involving an excessive consumption of fuel and time before the apartment is uniformly warmed.



COMPOUND BLOWER AND HEATER.

Not least among the practical advantages claimed for this system, are its compact form and the fact that its operation is under the perfect control of the attendant, who, without leaving the boiler room, can maintain any desired temperature throughout the building without interfering with his other duties. The incessant packing of valve stems, and repairing of leaky pipes and joints in unexpected and most undesirable places, is avoided, as any possible defect of this kind is confined to the space occupied by the heater, and is immediately detected and remedied. The reduced fire risk is also in favor of this system, as the steam pipes, being enclosed in a steel jacket, do not come into contact with wood-work, or accumulation of rubbish, paper, etc.

It is also pointed out that, in addition to its advantages as a heating apparatus pure and simple, it possesses also the advantages of positive and perfect ventilation—a consideration of no mean importance. The popular conception that fresh air and cold air are synonymous terms, in the sense that one implies the other, being at fault in this connection. The air in the rooms to be warmed being constantly displaced with air fresh from outside the building, heated, but losing none of its purity and invigorating qualities in its rapid passage through the heater, insures real ventilation, and in summer by simply shutting the steam off from heater without further alteration or adjustment, a constant supply of fresh cool air is forced to every part of the building, thus not only maintaining a refreshing coolness during the heated term, with the consequent increased capacity of employes for quantity and quality of work, but effectually dispelling as well all dampness in buildings having slight exposure to the sun's rays.

The accompanying diagrams were supplied by the Buffalo Forge Co., of Buffalo, N. Y., who furnished the apparatus shown, and who make a specialty of furnishing such apparatus for all kinds of buildings.

The Modern Steam Plant and its Management.

BY PETER H. BULLOCK.

Having discussed most of the appliances necessary for safely operating a boiler plant, and showed how some of the accidents that happen to them can be avoided, or best repaired when they have happened, we will now suppose that we have a set of boilers to operate, and will talk over the best way of doing the various things that constitute good management. We will also suppose that the boilers have got good, tight safety and stop valves, that the glass, water and steam gauges are of good make, and attached as described in former papers, that all the parts have been properly designed and constructed, and that all necessary implements and appliances are provided for economically operating the boilers. With such a plant, and with good fuel and help, surely a competent man had ought to be able to do much toward making the enterprise, of which the steam plant is an important part, a commercial success.

A FEW HINTS AND POINTS ABOUT THE FIRE-ROOM.

A man to be successful in any business, and ours as much as any, has got to have a good supply of self-confidence. Now do not for one minute mistake the vanity of self-conceit for the virtue of self-confidence, for they are as wide as the poles apart. The first is that something that is born of experience and makes a man feel as sure of what he is doing as he feels physically secure when his feet are on a solid rock. The latter is a shadow and a delusion. The conceited man is really aware of his own lack of skill, but he presumes on other people's ignorance of the fact, and professes to know and understand things of which he has no actual knowledge. Self-confidence in an engineer comes from a knowledge of his business in general, and a thorough acquaintance with every part of the plant of which he has charge. This knowledge should not only be perfect as to its present condition, but it should refer as well to its history, length of time it has been in service, what repairs and alterations have been made, and why. A man may say that he cares nothing for the history of his plant, so long as he knows how it is now, but this is not just so; for on what has been done to a plant, and how it has been run, very much may depend. It is valuable to know what has happened to any of the apparatus, and how the trouble was gotten over or repaired. Quite often a hint can be got from what has taken place, that will enable one to avoid the same thing or to better repair damages, should it occur again.

Don't try to improve the plant you have just taken charge of, too fast, for the first impressions may be based on imperfect knowledge of the reasons why things are as you find them.

During the first week the writer held a certain position, he improved a steam pipe, that started from the boiler room, dropped 13 feet, went across an alley way 11 feet wide, and up again on the other side to just opposite where it had started from. I pulled this out, run the pipe directly across, and covered it nicely with asbestos board, felt canvas, and paint. It worked fine, and I had 26 feet of pipe, a pair of broken chain tongs, and a lame back to my credit. In about a week a team came down that alley way from Brown's cooper shop with a load of barrels that towered some feet above my pipe. I told the driver that smaller loads were all the fashion, and that worthy referred me to a place where high temperatures and combustion are said to be thoroughly understood. Brown came down, and said that other —— fool that had the job before me tried the same thing, and had to pull it down. It had to come down. If I had studied the reasons why it was there, this work could have been saved.

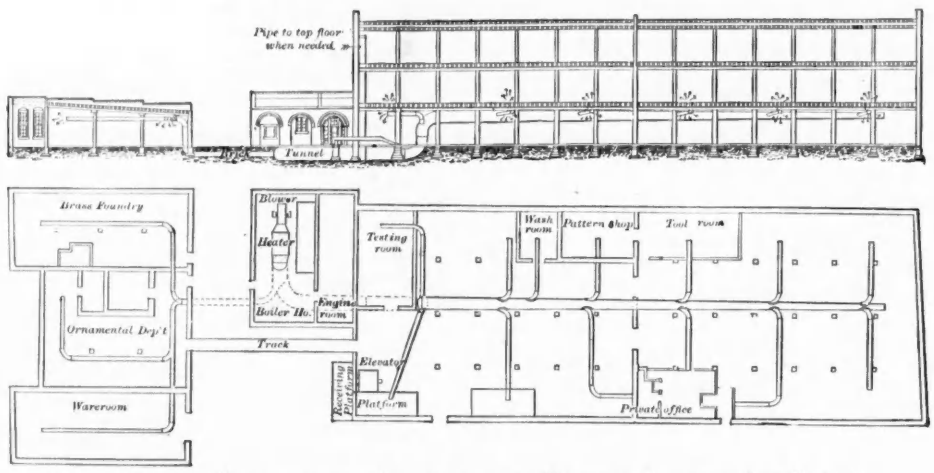
It is needless in an article of this kind to discuss the relative grate and heating surface or to give rules for determining their best proportion one to the other, for they are things that are generally fixed and settled when the plant is erected, and the engineer had better take hold and do his level best with things as he finds them, and suggest changes only as his experience shows them to be best, and the confidence of his employers in him will warrant.

Remember that confidence is a plant of slow growth, and that recommendations as to a man's ability are not always taken at their face value; consequently it is not well to attempt too many improvements until you have shown, by good work and results, that you are competent to devise and execute them with wisdom. Uprightness as a man and skill as an engineer will secure from any rational and fair-minded employer his confidence in your suggestions, which should be first for things that are necessary for safety of life, limb and operation, secondly for things that will promote economy, and lastly for things that go toward ease of operation, simplifying complicated apparatus or adding ornamental adjuncts.

An engineer should watch all the facts and processes of combustion, and if he sees anything about which he is in doubt, he should never give up till the matter is settled to his full satisfaction. Some days the boilers may steam easier than on others; if so, find out why; see if the heating surfaces have become coated more than usual, and if they have, clean them and find out why they were so. Get out your bent glass siphon, fit it to one end of a pipe, and put the other end into the chimney, pour some water into the glass, and see how much higher the water stands in one leg of the siphon than in the other. Try this when the wind is from different directions, and you may find that the shape and locations of the buildings around the boiler house make a good deal of difference in the draft of the boilers when the wind is from certain quarters, and that you can correct the difference by heavier or lighter firing to suit the conditions as they exist. I remember a fire-room where it was necessary to keep the windows open on the east side when the wind was from that way, in order to get a working draft for the fires. You may find that the temperature of the up take is higher than it should be, and more than is needed for the necessary draft; if so, find out the cause; it may be that the heating surfaces of the boiler have become coated with soot and dust, and that the heat is slipping up the flue, instead of generating steam. On the contrary, a low temperature of the escaping gases may not by any means indicate that you are getting good results from the fuel, for the combustion may be so imperfect, or there may be so much air getting into the furnace, that the temperature there is far below the best steam-making point.

Some men are forever watching the ash-heap, looking for some stray bits of coal, seeming to think that when fuel is changed into a high grade of ashes, that economy must surely be the result. But we must look further than this; we must get the most perfect combustion in the furnace, and produce the greatest possible amount of heat from the fuel burned there. The heating surfaces must be clean and in condition to absorb the heat from the gases as they come in contact with them, and the inside of the boilers must also be clean, so that the iron may quickly transmit the heat to the water. Observe at what height of water level the boilers will steam the easiest, and then maintain it there, by regular and constant feeding.

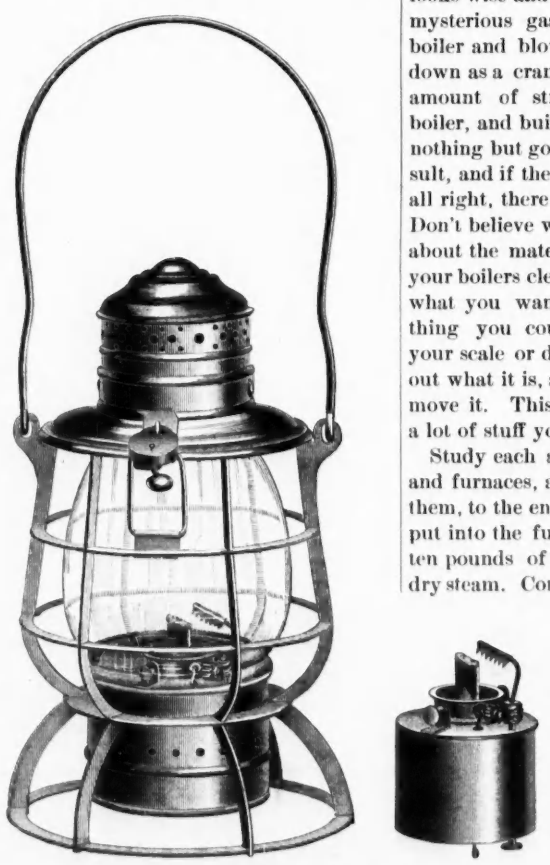
We should study cause and effect, first by seeing that the causes we put into operation have their intended and proper effect, and secondly, if we see any undesirable effect, work back from it, and don't give up till you have discovered the cause that produced it.



ELEVATION AND PLAN SHOWING APPLICATION OF HEATING SYSTEM.—SEE PAGE 1.

Don't take any stock in anything mysterious about boilers, for there is nothing of the kind. What may seem so is only something that we do not quite understand. If a boiler leaks there is a cause for it; hunt up that cause, remove it if possible, and get the leak repaired as soon as you can. If anybody looks wise and tells you that there is some mysterious gas that is liable to get into a boiler and blow it to smithereens, put him down as a crank; for if you put the proper amount of straight water into an honest boiler, and build a fire under it, you will get nothing but good respectable steam as a result, and if the boiler and its appliances are all right, there will be no explosion either. Don't believe what every agent will tell you about the material he has to sell for keeping your boilers clear of scale, for it may be just what you want, and it may be the worst thing you could use. Send a sample of your scale or deposit to a chemist and find out what it is, and then get something to remove it. This will be cheaper than to try a lot of stuff you know nothing about.

Study each and every part of the boilers and furnaces, and the best way of operating them, to the end that every pound of coal you put into the furnace may evaporate at least ten pounds of water in the boiler into good dry steam. Continually keep your attention on the results obtained, and do not reject any reasonable system or theory without giving it a fair trial. I once employed a fireman whose methods were entirely different from my own, but he silenced my criticisms by using less coal, and keeping a more even pressure of steam than had been done before. He knew that any saving would be appreciated, and he had no desire to handle six tons of coal per day, when five and a half would do the work. He took an interest in his work, and he has got a good job now.



STEEL SAFETY MILL LANTERN.

The methods of operating hard and soft coal fires are so entirely different that few persons are equally skillful at firing with both. A man that has learned to fire hard coal can more easily learn to use soft coal than the opposite, for he has only to overcome his caution regarding breaking up the fire, while in the latter case in using hard coal he must learn positively not to do it.

Good firemen are both born and made. Some get right at the work naturally; they take things easy, and keep up steam without any fuss; they are born firemen. Some learn after it has all been shown to them, and they have made their full quota of mistakes; they are made. Some never get there. They always do the wrong thing. They were born for something else; don't detain them in the search for their proper calling, but let them begin at once. You may be keeping a born lawyer handling coke, who should be studying Coke and Blackstone instead. You may find a born fireman that is foolishly trying to be something else; if so induce him to take up his proper calling at once, for born firemen are indeed scarce.

The tools of the fire-room are not of a very delicate nature, but the shovel, poker and iron wheelbarrow can be abused just the same as a monkey-wrench or an engine indicator, and there is a proper and fair way to use them, the same as there is for the latter implements. The fireman who always hits the door frame with the shovel will push the end of the slice bar into the bridge wall and bend or break it trying to upset that piece of masonry, will also drop the handles of the iron wheelbarrow, letting the legs strike the floor with a bang that threatens the existence of this useful vehicle, that is said to have been invented by Leonardo Di Venci.

There should be a kindly interest on the part of employer and engineer for the comfort and welfare of the firemen on whose skill and faithfulness the economical use of the coal very largely depend. A little expenditure for oatmeal and ice for use in the fire-room may prevent the working of the tin can "growler," which usually contains a liquid that cannot be recommended as a scale preventive for boilers, nor a safe beverage for their attendants.

Steel Safety Mill Lantern.

In the report of Mr. Edward Atkinson, President of the Boston Manufacturers' Mutual Fire Insurance Co. to the Associated Mutual Companies—a report from which we quoted at some length a few weeks since—the subject of lanterns was mentioned in the following language:

"Objection is frequently made to the use of kerosene oil lanterns in factories by the watchmen, however safely they may be made. On the other hand, a lantern has been called for, which may give more light than the ordinary sperm oil lantern. Another objection has been made to any lanterns yet offered, that, when exposed to corrosive vapors, the soldered joints are loosened and the lantern thus becomes dangerous.

"In order to meet all requirements, Messrs. F. O. Dewey & Sons, 28 Canal street, Boston [Mass.], have perfected a sperm oil lantern which will give much more light than the ones now in use. The wick can be cleaned from crust without opening the lantern. The lantern is covered by a steel frame so constructed that no corrosive action can affect the joints, and so strong that it will bear the weight of a man weighing two hundred pounds, either when tipped upon the side or subjected to the weight in the ordinary position.

"This lantern is not yet in the market; but the tools are being made, and in about thirty days the inventor will be ready for orders. We think it will meet all the objections yet made to the lanterns that are now in the market."

Since the report quoted above, the tools for the manufacture of this lantern have been completed, and we are able to present herewith an engraving showing it with the lamp in place, and one of the lamps separately.

The wick of this lantern is of such proportions that it gives about twice as much light as the ordinary sperm oil lantern, and it is believed that the danger of fire from it has been reduced to practically nothing. An element of danger has been found in watchmen's lanterns, from the fact of the lamps

being put in from the bottom and held in place by some sort of locking device, which, becoming out of order or being improperly fastened, allowed the lamp to fall out. Such an accident is wholly prevented in this lantern by constructing it with a solid bottom, so that the lamp can be removed in no other way but by lifting it out at the top.

The wick can be raised or lowered without opening the lantern, and the wick trimming device referred to is shown in cut of the lamp. They are furnished either with or without the locks shown, which, when they are used, enable the mill owner to prevent the watchman from opening the lantern under any circumstances, or the key may be fastened in a place where it is safe to open it, thus insuring that it shall be opened nowhere else about the mill or factory.

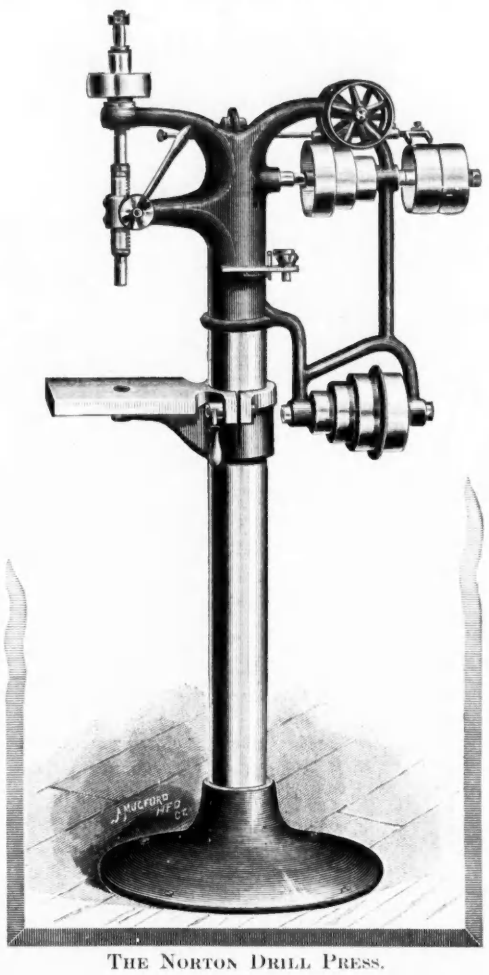
As an additional security against fire we can recommend the use of this lantern, in the confidence that it will be found trustworthy.

The Norton Drill Press.

We present with this an engraving which illustrates a new drill press, designed especially for light and fine drilling, its nominal capacity being for drills up to $\frac{1}{2}$" diameter.

No gears are used in the construction of the machine, the belt used for transmitting the motion running over the guide pulleys, shown above. The weight of the spindle is counterbalanced by a spring, the tension upon which can be readily changed to compensate for extra weight of tools or chucks used, thus securing the greatest possible sensitiveness, and reducing breakages of drills and other tools to the minimum. The weight of the table is also counterbalanced—a new feature in drill press construction, and one which adds much to the convenience of handling, as it allows the table to be unclamped, swung around freely, or adjusted vertically on the column without danger of falling. This balancing is effected by means of a weight in the center of the column. All necessary manipulations can be made from the front of the machine without the necessity for change of position by the operator. An adjustable collar provides a means of gauging the depth of holes, and each machine is provided with a shelf for the fixtures, drills, etc., used about the machine.

In the center of the table is a hole, to which is fitted the shank of a bell-center, while an index line upon the column affords a means of bringing it in line with the spindle, thus making it useful for centering shafts up to 33" in length. As to the general design we need say nothing, as it is clearly shown by the engraving. The machine will drill to the center of a 12" circle, and will drill holes 4" deep without readjustment. The greatest distance from the spindle to the table is 36", and the size of the table 10½"x11¼". The tight and loose pulleys are 5" diameter 1¾" face, the speed for general work being 450 revolutions, and the weight 275 lbs. The maker is W. P. Norton, Bristol, Conn.



THE NORTON DRILL PRESS.

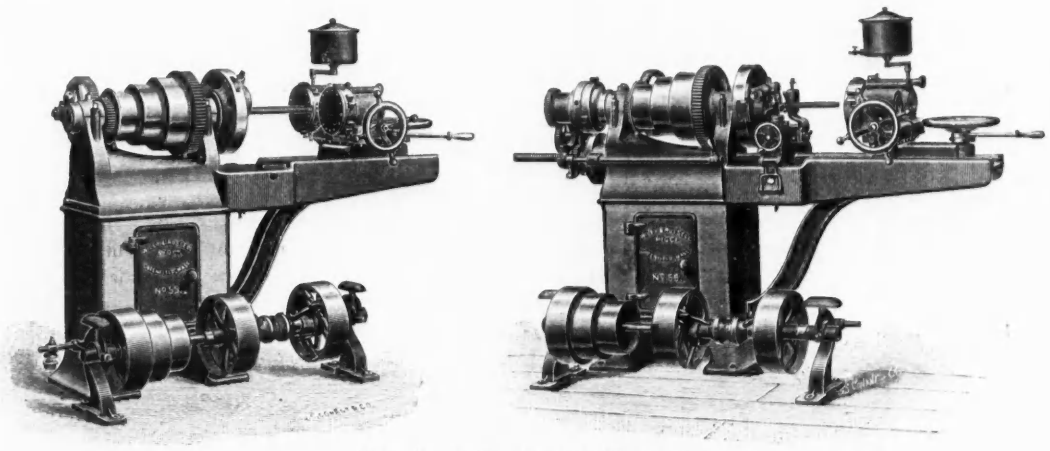
New Bolt Threading Machine.

A machine for threading bolts and pipe, and for tapping nuts, to which is also attached, when desired, a cross-slide and tool-rest for cutting off stock, is shown by the accompanying engravings, having recently been brought out by the Wiley & Russell Manufacturing Co., Greenfield, Mass. The first of the two cuts is of the plain machine, having back gears which can be thrown in or out the same as those of a lathe, and a hollow spindle, the hole through it being 2½" diameter.

The dies are carried in two equal wheels set side by side, and controlled by a right and left screw, each die being divided, the half in one wheel opposite to the half in the other, in such a manner that a complete working die is made by bringing the wheels together, and the finished screw released by separating them, thus saving running back over the threads. The second cut shows the same machine provided with the cutting-off attachment referred to above, and having also a screw attached to the carriage, and passing through the bed underneath the head to a nut driven by change gears from the spindle. Thus, by simply putting on the proper gears, greater accuracy of pitch can be secured in cutting long, coarse or square threaded screws than is possible where the die alone is depended upon for this.

This machine has also an extra chuck on the back end of the spindle for more firmly holding long work, especially in cutting off stock.

In both machines the base forms a cupboard for the reception of dies not in use, etc., and a countershaft with friction clutches accompanies either style.


NEW BOLT THREADING MACHINE.

The Best Set Squares.

W. H. BOOTH.

The best set squares for drawing purposes are undoubtedly made of glass, of which material the writer has made his own triangles for many years.

According to size and the users' choice they may be from $\frac{1}{16}$ to $\frac{1}{8}$ inch in thickness and are of course cheapest made from broken windows. In order to render most easy the work of accurately adjusting them, they should first be cut as nearly correct as possible with a good glazier's diamond. They are then to be trued up, to do which each edge must first be rubbed on a flat surface covered by a piece of coarse emery cloth. This will remove the keen cutting edges and make them safe for further handling. Next test the square to find how much each angle is out of truth. Sometimes it will be found that one angle is exactly cut, in which case the two adjacent sides simply require leveling up to a straight edge and all heavy grinding is put into the third side. At others every side may require considerable dressing off before a straight edge is obtained, for the cut of the diamond will not always be very straight. When much material has to be removed, a wet grindstone will prove very handy, or a flat slab—a sandstone door-step, for example,—will grind glass very rapidly. For final truing up, a level board and emery cloth is to be used, and as the tendency is to grind the corners away quicker than the middle parts, it is as well to use strips of cloth narrower than the lengths of the sides being ground. A very little experience will serve to show how to secure straight edges, and they may be finally finished by using two further gradations of cloth; for, if not left fairly smooth, the ground edges are apt to grind away the back nib of the drawing pen where the latter presses against the square. Hence it is well to get up the edges almost to a polish. Once trued up, these glass triangles ever remain true, and though sometimes they absorb considerable time in being made absolutely true, both as straight edges and as angles, such time is soon saved as compared with the continued waste of time in *repeatedly* adjusting wooden triangles. Glass triangles, too, have the advantage over those of vulcanite both in accuracy and cleanliness, and they are also transparent, which is an immense gain, for every draftsman has experienced the inconvenience of the solid square hiding portions of the drawing, which often necessitates the sliding back of the triangle. Further, a glass triangle may be slidden over a wet line of Indian ink *without* smearing the wet ink upon the paper. This is curious, but so much a fact that the writer has never seen it occur over a period of some ten years or more. The wet line smears, but it is upon the under side of the glass, not upon the paper. Some users of glass triangles may prefer to attach three ⅜" inch disks of paper on each side. These lift the triangle above the paper surface and perhaps prevent scratching from gritty particles. Beyond their liability to fracture if allowed to fall—and this could be overcome by using La Bastil glass—glass set squares have in every point a great advantage over other materials, and it is almost better that a triangle should fracture than that a fall should warp it.

To sum up, wood is wholly unreliable, though nice and light. Vulcanite is exceedingly dirty, and usually far too thick, though usually claimed to be accurate—a moot point. Brass is accurate and unchangeable, though heavy, and not reliable after a fall. Steel is liable to be dirty, but is too heavy if thick enough. If of good quality it may be cut out to a skeleton only, and stand considerable hard usage.

Glass has none of these faults, and need not be brittle. Try it.

The Nature of Electricity.

The question, What is electricity? appears to have been satisfactorily answered by Herr H. Hertz, who, it will be remembered, last year succeeded in experimentally demonstrating the undulatory transmission of electrical inductive action through the air and in conduits. Herr Hertz has since made some further experiments, the results of which he has communicated in a paper to the Berlin Academy of Sciences. The rays of electricity are created by a special arrangement, and their presence and effects are shown by a resonator, the latter of which it is Hertz's special merit to have invented. Concave mirrors of zinc plate, which he employs, act on the electric rays as they would on rays of light, and by manipulating these rays all the elementary experiments usually made with rays of light can be repeated. The electric ray shows itself capable of being rectilineally polarized; it is diffused in a rectilinear direction, is reflected regularly like a ray of light, and undergoes, in passing through a prism of so-called hard-pitch, a refraction which gives for the material an index of refraction of 1.69. This agrees most singularly with the optical refraction exponent, ranging between 1.5 and 1.6, as given for bodies belonging to the resin family. Herr Hertz, therefore, thinks himself justified in describing electrical rays as rays of light of very great undulatory length, and he concludes his paper as follows:—"The experiments described appear to me to be greatly instrumental in removing doubts as to the identity of light, radiant heat, and electro-dynamic undulatory motion. I believe that in future we may confidently utilize the advantages arising from the acceptance of this identity, both to the domain of optics and to electrical science."—*Iron.*

We find the following in one of our contemporaries, credited to "*Ex.*"

One of the most extensive newspaper expeditions ever projected in this country is that which the Scripps League of western newspapers will send out during the coming July. As Congress took no steps toward sending American workingmen to the Paris Exposition with a view to examining the advance of mechanical arts, this newspaper syndicate stepped into the breach, and has undertaken the work which Congress overlooked. They propose to spend anywhere up to $25,000 in paying all the expenses of 50 American workingmen chosen from St. Louis, Cincinnati, New York, Boston, Detroit, Cleveland, Chicago and other manufacturing points. The details of choosing the men who are to accompany the expedition are now being arranged, and it is not unlikely that representatives from this city may be among those who accompany it. All trades will be represented, including iron workers, car workers, shipbuilders, carpenters, molders, printers, etc. All workingmen's organizations are invited to correspond with the manager Paris Exposition Scripps League, Detroit, Mich., concerning the selection of men.

We have heard considerable about the pluck and skill of the captain of the British man-of-war Calliope, the only vessel which escaped from the harbor of Apia during the great storm, but until recently have noticed nothing regarding the skill or heroism of the engineers, who, by sticking to their posts and working the engines to their utmost capacity, were able to make the slight headway against the storm, which saved the vessel. Now, however, it is gratifying to note that engineer Bourke has been promoted to be fleet engineer, in recognition of his services on that occasion.

A correspondent wishes to know how he can harden and temper pieces of steel wire No. 16 N. G., and keep them straight.

Details of Sweet's 16-Inch Engine Lathe.

BY PROF. C. I. KING.

IV.

Fig. 20 shows a general plan of the carriage and tool post. Owing to the construction of the head-stock and the gap, the arm a forming the back bearing of the carriage does not extend to the left side of the cross slide. A T-slot for bolt heads extends the full length of a. The section $c\ c$ shows the construction of the arm a, also of the gib piece which holds the carriage down at the back side. A projection of the bed shown in section at S, Fig. 22 (page 5), fits the recess R, Fig. 21, and gives an exceptionally large bearing. The opening A', Fig. 21, extends the full length of the gib, and receives a rectangular steel bar, shown in plan at S'. This piece is made to fit closely in groove A, but will slide endwise easily. Its operation is as follows: A steel clamp, shown in section at C, Fig. 22, and in plan at C', is placed on the lathe bed, and the reduced end of the bar S' slides through the projecting jaws of the clamp. Taper holes and pins are provided in the bar for different lengths of screws, and when the pins are drawn to the clamp by the movement of the carriage, the bars stop until the tongue shown in section at T, Fig. 24, reaches the offset in the slot, when the tool post is carried back and forward by the amount of difference in the plane of the slot. The device is shown in transverse section at T', Fig. 32, and its action is further described in connection with this figure. The construction of the front side of the carriage is shown in section $A\ A$ and $B\ B$, Figs. 25 and 26. The front side of the bed of the lathe projects under and beyond the groove g, Fig. 26, which receives a steel strip so fastened that it moves with the carriage, but can drop of its own weight on the bed. This prevents the turnings from falling down on the guide. A plan of the tool post is shown at P. The graduated disk at d is in direct connection with the main screw, and by observing the position of the disk, the operator may, when cutting screws, disengage the carriage and run it back by hand, set his tool for a new cut, and when the disk comes in position, throw in the nut, and the tool will coincide with its previous path. The section $E\ F$, Fig. 28, shows the construction of the friction feed clamp; the shaft S'' and gear g', which engages with the rack, are one piece. S'' is put in position from the back side of the carriage, and the worm wheel W' and gear g'' go on from the outside. To increase the area of the bearing of W', its hub is extended outward to the plane of the disk of g'', while the hub of the gear extends over W' to its disk. On the outside of g'' the hub extends through the cover plate P', and is there connected with the star nut N by means of two half rings $R\ R$ recessed into the hub of N, and screwed to the hub of g''. A key K is fitted in the shaft s'', and connects with the gear. To gain access to gears 1, 2, 3 and g'', it is necessary only to remove plate P', these wheels coming off with it. This will also expose the remainder of the inside mechanism. The device for clamping the carriage in position is shown at C''', Fig. 26. An eccentric is turned on the inner end of the shaft, to which is fitted a block B'' which has a vertical movement as the shaft turns. The index plate is moved by two small spiral gears g_1, g_2, Figs. 27 and 28, which connect with the main screw, g_2 being fastened to the shaft S'''. Motion is imparted to the feed train from the screw by two 45° spiral gears; the one on the screw is shown in the longitudinal and transverse section at G, Fig. 29. This gear is of steel and has short keys in each end which fit the spline of the screw. Two journals are turned—one on each side of the gear—and they fit in the bearings shown at Fig. 29.

In Fig. 27, the arrangement is shown of the wheels in position with the cover plate removed. The second spiral gear is shown at G', and near the middle of the shaft s''' is the worm W'', shown in dotted lines. At the upper end of S''' is a second worm W''', which drives a spiral gear fast to a sleeve on the cross-feed screw. The nut is drawn in and out by means of a steel lever L, and eccentric E', Fig. 27. At the opposite end of L are two slots diverging at the necessary angle, and a pin from each half of the nut fits into these slots. A separate plan and side elevation of the nut is shown at Fig. 30. The cam C_1, Fig. 27, is fast to the eccentric shaft; one end of this cam turns in such a position as to prevent clamping the feed train when the nut is in use, and by reversing it, it prevents putting in the nut when the friction is in use.

In the vertical section $G\ H$, Fig. 31, the cam C_1 is shown in place with the nut open, and the eccentric cannot be turned unless the gear g'' be withdrawn sufficiently to let the step g' on the cam pass the worm. The shaft s'' is oiled through the holes $O\ O$, the oil being distributed from the inside. The transverse section $C\ D$, Fig. 32, fully represents the position of the two spiral wheels $g_1\ g_2$.

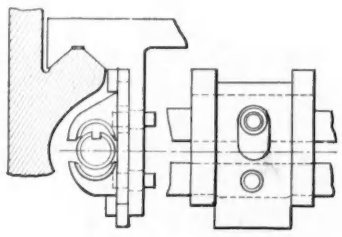


Fig. 30

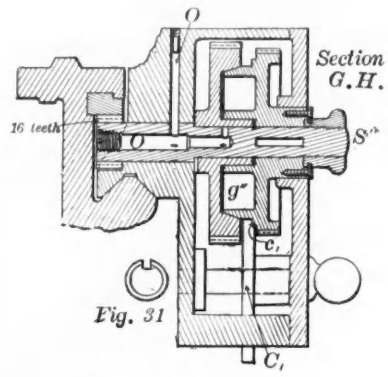


Fig. 31

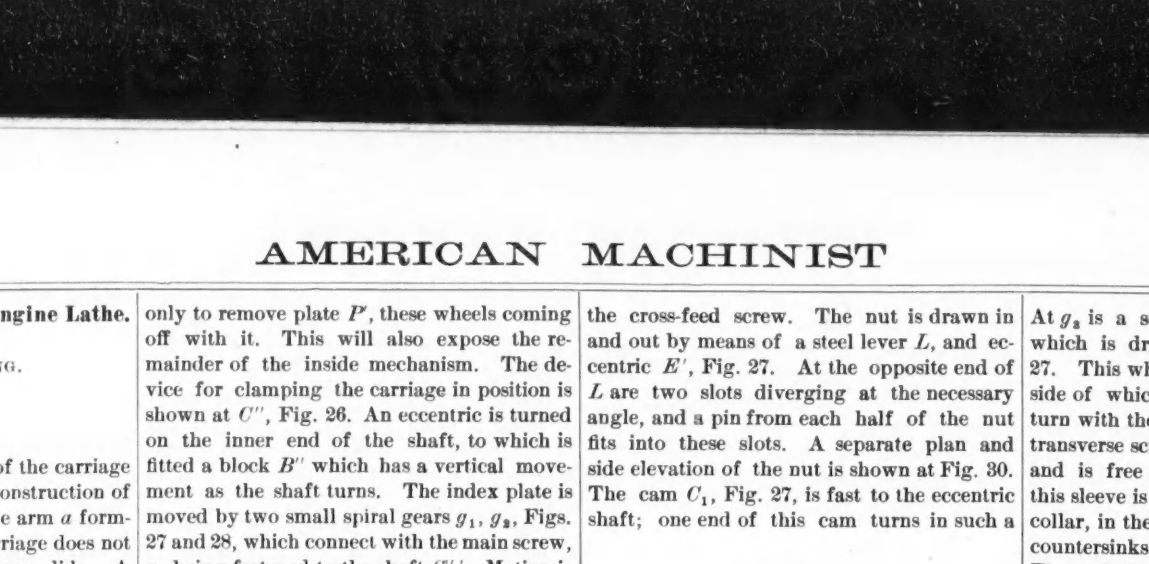


Fig. 27

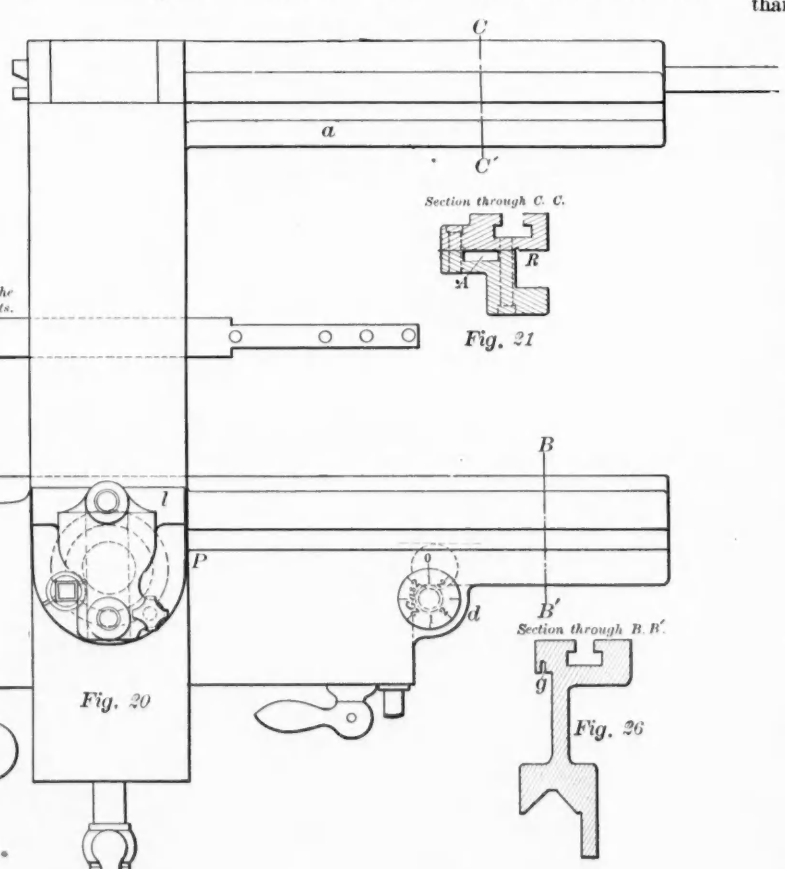


Fig. 24

Fig. 21

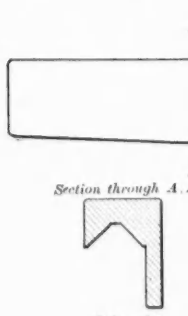


Fig. 25

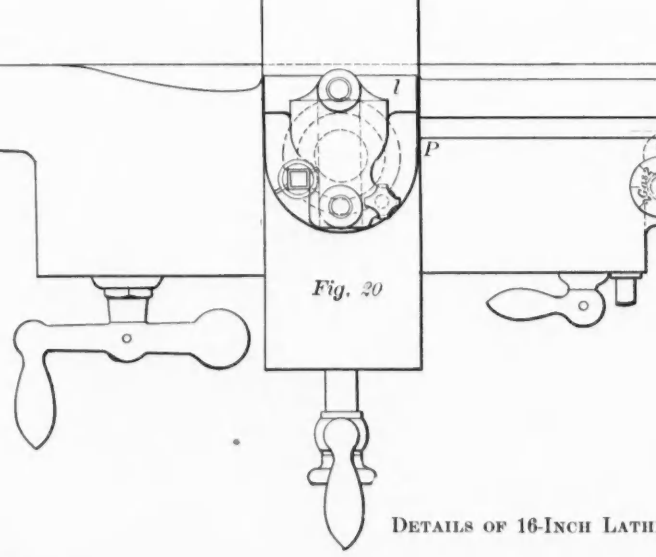


Fig. 20

Fig. 26

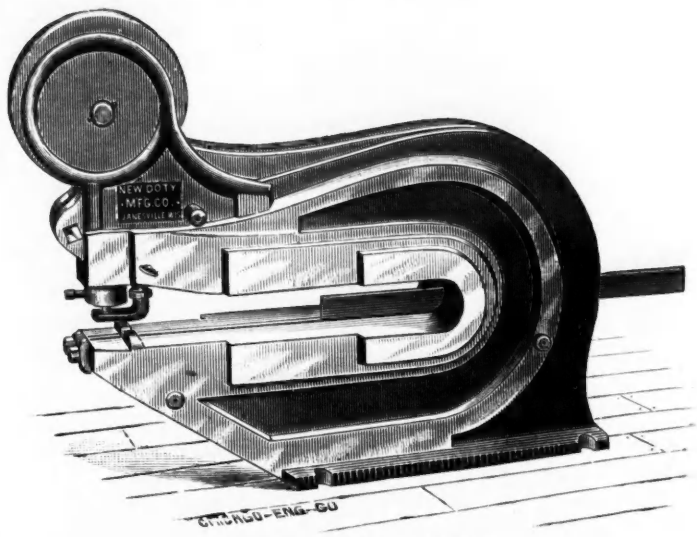
DETAILS OF 16-INCH LATHE.

It is quite evident from the accounts published in recent Fitchburg papers, that Mr. John J. Grant, whose name is familiar to most of our readers, is capable of managing other matters besides machine shops and manufacturing establishments. A concert given in Fitchburg for the benefit of the Johnstown sufferers, of which he was the manager and one of the star performers, receives high praise from *The Evening Mail*, and netted, according to the published report of Mr. Grant, the sum of $554.50.

During May, twenty-five vessels, with an aggregate tonnage of 35,143 tons, were launched from the Clyde shipyards, against 14,156 tons in the same period of 1888. For the five months the total tonnage put into the water has been 115,493, against 73,793 in the corresponding period of last year.—*Engineer*.

Deep-Jawed Hand Punch.

We illustrate with this a small punch made by the New Doty Manufacturing Co., Janesville, Wis., which is specially adapted to doing the lighter punching where a greater depth of jaw is needed than is usual with machines of its capacity. It will punch a $\frac{1}{4}''$ hole in $\frac{1}{8}''$ iron to the center of 30". The punch is operated by an eccentric, which, in turn, is worked by a hand lever. The plungers and all bolts are of steel; all necessary gauges are provided, and it is fitted with an improved stripper, which is adjustable to the slightest variation. Three sizes of punches and dies are furnished with each machine, $\frac{1}{8}''$, $\frac{3}{16}''$ and $\frac{1}{4}''$ diameter.



DEEP-JAWED HAND PUNCH.

The Italian Cruiser "Piemonte."

Official trials of the Italian cruiser "Piemonte" have recently been made, which gave the following results: During a natural draft trial of four hours' duration, a mean speed of 20.4 knots was attained with about 7,000 indicated horse-power, and during a forced draft trial of one and a half hours' duration a measured mile speed of 22.3 knots was attained with a mean power of 12,700 horses, the maximum power which was maintained for a considerable time exceeding 13,000 horse-power. She is specially designed for steaming with open stokeholds, and it is believed that she can attain a speed of $20\frac{1}{2}$ knots with natural draft, or with a pressure in the stokeholds not exceeding half an inch of water, the pressure allowed for developing the natural draft power when the wind is not sufficiently favorable for the purpose, $20\frac{1}{2}$ knots may be regarded as her ocean-going speed.

The "Piemonte" is 300 feet long, 38 feet broad, and 15 feet mean draft, and her displacement is 2,500 tons. She has a protective deck with sloping sides from stem to stern, this deck being one inch thick along the middle, and three inches thick on the slopes. Her armament consists of six 6-inch quick-firing guns, six $4\frac{7}{10}$-inch quick-firing guns, ten 6-pounder Hotchkiss guns, six 1-pounder Hotchkiss guns, 10 M. M. Maxim guns, and three torpedo tubes.

The machinery consists of two sets of vertical triple-expansion engines. Each set has two low-pressure engines, and therefore acts on four cranks. High-pressure cylinder, 36 inches; intermediate, 55 inches; low-pressure, each 60 inches, and the stroke is 27 inches. Steam is generated in four double-ended boilers adapted for a working pressure of 155 pounds. Another boiler supplies steam to any of the auxiliary engines throughout the ship.

The engines are wholly below the water-line, and protected by the armor deck; so also, of course, are the magazines, steering gear, etc. The vessel can carry 600 tons of coal, which will enable her to steam at full speed a distance of 1,950 knots, but she will be able to maintain a cruising speed of from 10 to 12 knots for from 50 to 60 days, during which she could cover a distance of 13,500 knots.

Special arrangements have been made for securing good turning power in the ship; at the trials made it was shown that the ship could maneuver exceedingly well, completing a circle of 508 yards in 3 minutes 24 seconds. It is stated that the "Piemonte" will be capable of discharging against an adversary in a given time twice the weight of shot and shell that could be fired by the largest war vessel now afloat.

An Address of Welcome.

We think it may safely be said that seldom have a body of men visiting a foreign country been received with more marked attention and evidences of esteem than have attended the visit of the various engineering societies to England. We append an address delivered to them, which, it must be conceded, is a model of appropriateness, and does credit to its authors as well as to the engineering bodies who received it.

TO THE PRESIDENTS OF THE AMERICAN SOCIETIES OF CIVIL, MINING, MECHANICAL AND ELECTRICAL ENGINEERS.

We, the President, Vice Presidents, Council, and members of the Institution of Civil Engineers, acting on this occasion both for ourselves and the various bodies of engineers of the United Kingdom, hereby tender to you, as representatives of the members of the several engineering societies of America, a sincere and cordial welcome to this country, and gladly avail ourselves of the opportunity of publicly acknowledging, and as far as possible reciprocating, the manifold courtesies which for many years past have been lavished on British engineers visiting the great republic.

It is a source of peculiar satisfaction to receive you within this building, because we are here in the home of the parent of all the duly constituted engineering societies of this kingdom.

The association of engineers in England into one body, for their common advantage, originated with Smeaton, one of the fathers of the profession; it was not, however, until 25 years after his death, viz., in 1817—well-nigh three-quarters of a century ago—that the present institution was actually formed.

Telford became its president in 1820, and in 1828 it received the royal charter, under which it has ever since flourished. In regard to magnitude, it is sufficient to state that our institution now comprises (including the class of students) upwards of 5,700 members, and is largely adding to its numbers every year.

Although the civil engineers act as hosts in your reception, the several engineering bodies of the country are associated with us; and others outside our profession join in the welcome, and have rendered valuable aid in our endeavors to secure your comfort and gratification.

Foremost of all must be mentioned the special permission, given by Her Most Gracious Majesty the Queen, for you to visit and inspect her royal palaces and domains, at Windsor and in the metropolis. Nor must we omit to place on record the very exceptional and gratifying fact that the Lord Mayor, Aldermen and Common Council of the City of London have been pleased to place at the disposal of the reception committee the use of their ancient and noble Guidhall, in order that we may entertain you, in accordance with old English custom, at a festival dinner therein.

The leading railway, dock, gas and water companies have vied with each in exercising hospitality, nor have private individuals been lacking in the earnest desire to add to your gratification whilst in our midst.

It would be superfluous and presumptuous to enlarge on the professional merits of American engineers. Their great works and clever inventions have passed far beyond the sphere of mere techincal appreciation, and have become of world-wide celebrity. We feel justified in regarding the influence of you and your predecessors as one of the principal factors which have raised, with unexampled rapidity, the modest republic of George Washington to one of the foremost nations on earth.

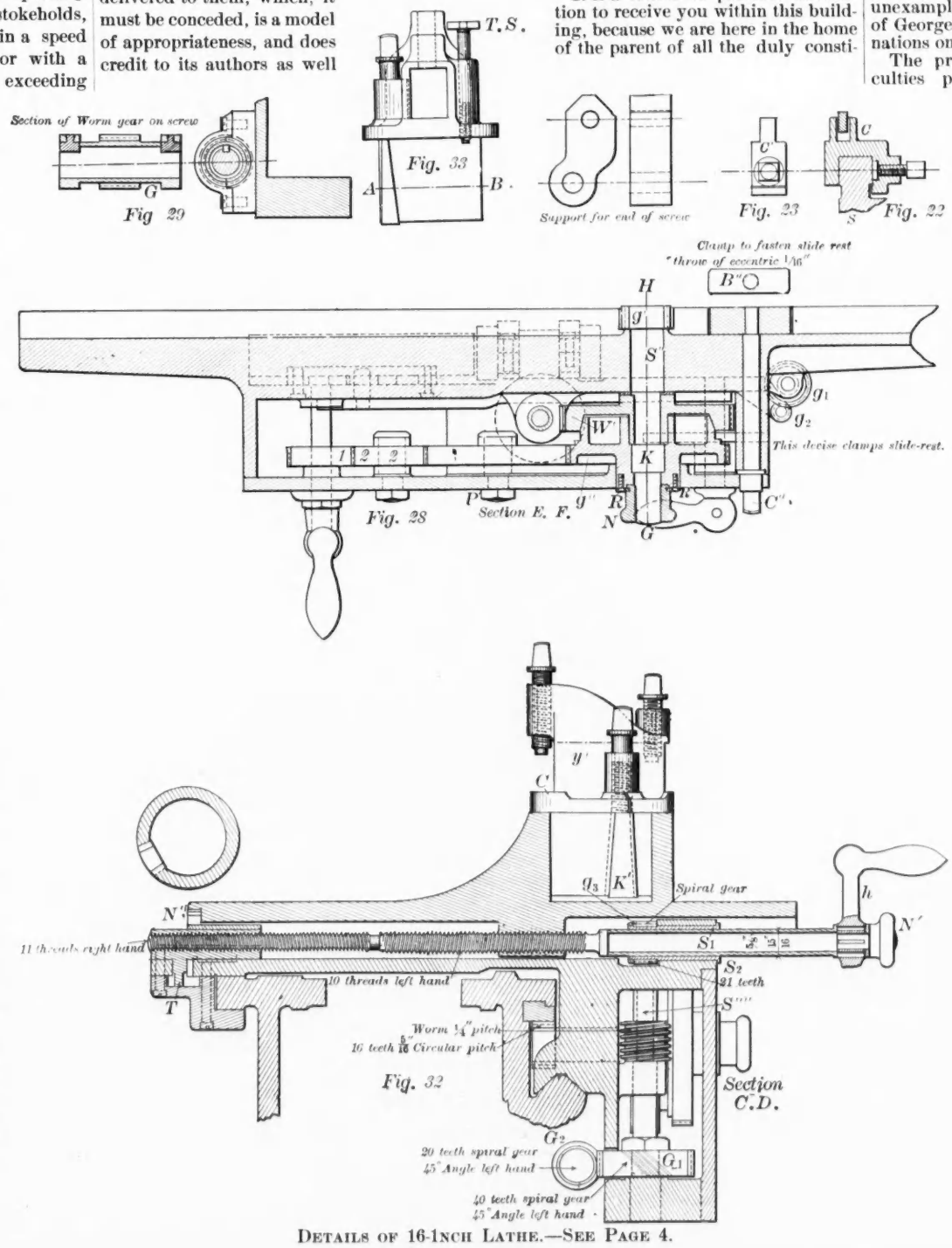
The problem of dealing with great difficulties presented by nature, and until recently, with comparatively limited means and limited appliances, has been solved by the American engineer, and the solution has left its mark upon the character of the nation.

With a population about double our own, and a territory stretching between ocean and ocean, more than 3,000 miles from east to west, not to speak of its extent from north to south, distances have been conquered by your vast system of railways on a scale of magnitude of which we have no experience.

We trust that all the arrangements made for your visits to some of the most important public works in this kingdom will be successful and acceptable, and we hope you may carry back pleasant recollections of your visit to this country.

Witness our hands and seal at Westminister this 13th day of June, 1889.

JNO. COODE, *President.*
JAMES FORREST, *Secretary.*



DETAILS OF 16-INCH LATHE.—SEE PAGE 4.

An interesting experiment was made on Wednesday last at the Eiffel Tower, when the safety appliances of an "Otis" lift were tested previous to their being opened for public use. The lift in question consisted of two compartments one above the other, and weighs eleven tons. It was loaded with three tons of lead and raised to a considerable height, where it was fastened with ordinary ropes, the steel wire cables being detached from it with the intention of cutting this rope, letting the lift fall, and so ascertain whether the brakes would work properly and support the lift. The experiment was perfectly successful, the lift being gradually and quietly brought to rest, without the slightest shock, at a distance of about 40 feet above the ground. —*Engineering* (London).

Latest reports given in our English exchanges indicate that the boom in what are there called the engineering trades continues, and that the number of men who are now out of employment is remarkably small. The Steam Engine Makers' Society is unable to meet the demands for workmen from employers, especially with regard to pattern makers and smiths.

Practical Drawing.

BY J. G. A. MEYER.

EIGHTIETH PAPER.

583. *Definitions.*—Let $e\ a\ d$, Fig. 489*a*, represent a pyramid, and $a_3\ d_3$ a cutting plane parallel to the base $a\ d$, then the shaded portion below the cutting plane is called the *frustum* of a pyramid. In short, a frustum of a pyramid is a portion of a pyramid intercepted between the base and a plane parallel to the base.

584. The polygon obtained by passing the plane $a_3\ d_3$ through the pyramid is called the upper base of the frustum of the pyramid; and $a\ d$ is called the lower base.

585. The *slant* height of a frustum of a right pyramid is the portion of the slant height of the pyramid intercepted between the bases of the frustum.

In Fig. 489*a* we do not see the slant height of the frustum of the pyramid. If, on the other hand, the elevation of the same pyramid be drawn as shown in Fig. 483*a*, and the cutting plane represented by the line $x\ y$, then the slant height of the frustum of the pyramid will be represented by the line $a\ x$ or $e\ y$.

586. Let $e\ a\ d$, Fig. 488*a*, represent a pyramid through which is passed a plane $a_3\ d_3$, not parallel to the base $a\ d$; the portion intercepted between the plane $a_3\ d_3$ and the base is called a truncated pyramid. The polygon obtained by the cutting plane $a_3\ d_3$ is called the upper base, and $a\ d$ the lower base.

Problem 88.

587. *Intersection of a pyramid with a plane:*

Let $e\ a\ d$, Fig. 488*a*, represent the vertical projection or elevation of right pyramid with an hexagonal base, and let the line $a_3\ d_3$ represent the cutting plane; it is required, first, to find the horizontal projection or plan (Fig. 488) of the truncated pyramid; second, to find the true outline of the upper base of the truncated pyramid.

First, to find the horizontal projection. At any convenient distance below $a\ d$, draw a horizontal line $a_2\ d_2$; through the point a draw a vertical line, cutting $a_2\ d_2$ in the point a_2; also through e draw a vertical line cutting $a_2\ d_2$ in the point e_2. Through the point a_2 (Fig. 488) draw a line $a_2\ f_2$, making an angle of 60 degrees with the line $a_2\ d_2$—this can be quickly drawn with the set square shown in Fig. 48. From e_2 as a center describe a circle tangent to the line $a_2\ f_2$ (this circle is not shown); around this circle, and tangent to it, draw the lines $f_2\ e_2$, $e_2\ d_2$, $d_2\ c_2$, etc., as explained in Art. 194 and plainly shown in Fig. 146; the hexagon thus drawn will be the horizontal projection of the lower base. Draw the diagonals $f_2\ c_2$, and $e_2\ b_2$, which will complete the horizontal projection of the pyramid. If so far the horizontal projection has been correctly drawn, the point b in Fig. 488*a*, and the points f_2, b_2 in Fig. 488 will lie in one vertical line; also the points c, e_2, c_2 will lie in another vertical line. We call attention to this fact, because it is of the utmost importance to have the diagonals $f_2\ c_2$ and $e_2\ b_2$ drawn in the correct position. Through the point a_3, in which the cutting plane intersects the line $e\ a$ (Fig. 488*a*), draw a vertical line cutting the diagonal $a_2\ b_2$ (Fig. 488) in the point a_4; through the point b_3 draw a vertical line cutting the diagonals $f_2\ c_2$ and $b_2\ e_2$ in the points f_4 and b_4; again, through the point c_3 draw a vertical line cutting the diagonals $b_2\ e_2$ and $f_2\ c_2$ in the points e_4 and c_4; lastly, through the point d_3 draw a vertical line cutting the diagonal $a_2\ d_2$ in the point d_4. Join the points a_4 and f_4, f_4 and e_4, e_4 and d_4, d_4 and c_4, c_4 and b_4, b_4 and a_4 by straight lines; this completes the horizontal projection of the truncated pyramid; the polygon, $a_4\ b_4\ c_4\ d_4\ e_4\ f_4$, will be the horizontal projection of the upper base. Since this upper base is not parallel to the horizontal plane of projection, we do not see the correct distance from a_4 to d_4, or from b_4 to c_4; but, on the other hand, since the cutting plane is perpendicular to the vertical plane of projection, we see the true distances in a direction perpendicular to $a_3\ d_3$; that is to say, we see the true distance between points b_4 and f_4; also that between the points c_4 and e_4. Therefore, to find the true form of the upper base, we proceed as follows: Anywhere above the line $a_3\ d_3$, and parallel to it, draw the straight line $a_5\ d_5$ (Fig. 488*b*). Through the points a_3, b_3, c_3, d_3 draw lines perpendicular to $a_3\ d_3$, cutting the line $a_5\ d_5$ in the points a_5, m_2, n_2 and d_5. The points m_2, n_2 are represented in Fig. 488 by the points m and n, in which the verticals through b_3 and c_3 intersect the diagonal $a_2\ b_2$. From the point m_2 as a center, and with a radius equal to $m\ f_4$ or $m\ b_4$ (these are equal), describe two short arcs, cutting the line $b_3\ b_5$ in the points b_5 and f_5; again, from the point n_2 as a center, and with a radius equal to $n\ e_4$ or $n\ c_4$, describe two short arcs cutting the line $c_3\ c_5$ in the points c_5 and e_5. Join the points $a_5\ b_5$, $b_5\ c_5$, $c_5\ d_5$, $d_5\ e_5$, $e_5\ f_5$ and $f_5\ a_5$ by straight lines, and thus complete the outline of the shaded surface in Fig. 488*b*, which gives the correct dimensions of the upper base of the truncated pyramid.

The principles upon which this construction are based may be briefly stated thus: The cutting plane $a_3\ d_3$ is turned about its trace (that is, the line in which the cutting plane intersects the vertical plane of projection,) until it coincides with the surface of the paper, thereby enabling us to see the true dimensions of the boundary lines of the upper base which this cutting plane contains. In turning the cutting plane around its trace, the points a_3, b_3, c_3, d_3, will move in paths which are represented by lines passing through these points perpendicular to $a_3\ d_3$; and for this reason the lines $a_5\ a_3$, $b_5\ b_3$, etc., must always be drawn perpendicular to the cutting plane $a_3\ d_3$ (see Art. 320). And, finally, when the cutting plane coincides with the plane of the paper, we know that the points b_5, m_2, f_5, must lie in the line $b_3\ b_5$, and since we see the correct distance between these points in Fig. 488, we have only to make the distance between b_5 and m_2 equal to $b_4\ m$, and $m_2\ f_5$ equal to $m\ f_4$. Similar reasoning applies to the points c_5 and e_5.

From the foregoing we learn that if the projections of the truncated pyramid in Figs. 488, 488*a*, represent two views, say, of a tin box, and we wish to make a cover $a_3\ d_3$ for this box, we must cut the cover to coincide with the outline of the shaded surface in Fig. 488*b*, and not to the horizontal projection of the upper base, which is represented in Fig. 488 by the polygon $a_4\ d_4\ f_4\ c_4$; because the latter polygon only shows the correct width of the upper base, but does not show its correct length, whereas in Fig. 488*b* the correct length and width are shown. Yet the horizontal projection of the upper base in Fig. 488 is by no means useless, as it will be perceived that without it we could not have obtained the proper width of the shaded surface in Fig. 488*b*.

Directions.—In the space marked 88, draw the vertical projections of a right pyramid with hexagonal base; the distance across corners, that is, from a to d in Fig. 488*a*, is to be 7 inches, altitude 7 inches; draw a cutting plane $a_3\ d_3$ in such a position that $a\ a_3$ is equal to 2 inches, and $d\ d_3$ equal to 4 inches. Find the horizontal projection of the truncated pyramid, and also the true outline of the upper base. Use a 3-inch scale.

Problem 89.

588. *Development of the convex surface of a frustum of a pyramid.*

Let $a\ d\ a_3\ d_3$, Fig. 489*a*, be the vertical, and Fig. 489 the horizontal projection of a frustum of a right pyramid; it is required to find the development of the convex surface of the frustum of the pyramid.

Our first step will be to find the vertex e; this is done by prolonging the lines $a\ a_3$ and $d\ d_3$ until they meet, and thus obtain the point e, which is the vertex of the pyramid.

According to what has been said in previous problems, we know that the line $e\ a$ represents the correct length of the lateral edges of the pyramid; hence:

From any point e_3 (Fig. 490) as a center, and with a radius equal to $e\ a$, describe an arc $A_3\ d_3\ a_3$. Through the point e_3 draw any straight line $A\ e_3$, intersecting the arc $A_3\ d_3\ a_3$ in the point A_3. Now, because the pyramid has six lateral faces, we lay off from the point A_3 on the arc $A_3\ d_3\ a_3$ six points, $b_3\ c_3\ d_3\ e_3\ f_3$ and a_3; the distance between any two adjacent points must be equal to the length of a side of the lower base in Fig. 489, for instance, equal to $a_2\ b_2$; we say, equal to any one of the sides of the lower base, because we have to deal with the frustum of right pyramid, and the sides of the base of a right pyramid will, according to our definitions, be equal to each other. Join the points A_3, b_3, b_3, c_3, etc., by straight lines; also through e_3 draw straight lines, terminating in the points b_3, c_3, d_3, etc. From the point e_3 as a center, and with a radius equal to $e\ a_3$ (Fig. 489*a*) describe an arc $A_5\ d_5\ a_5$, cutting the lines $e_3\ A_3$, $e_3\ b_3$, etc., in the points A_5, b_5, etc. Join the points A_5 and b_5, b_5 and c_5, and so on, by straight lines, and thus complete the outline of the shaded surface which is the development of the convex surface of the given frustum of the pyramid.

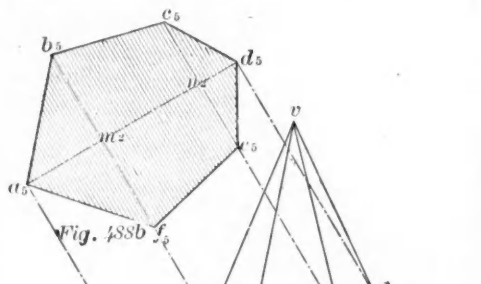


Fig. 488*b*

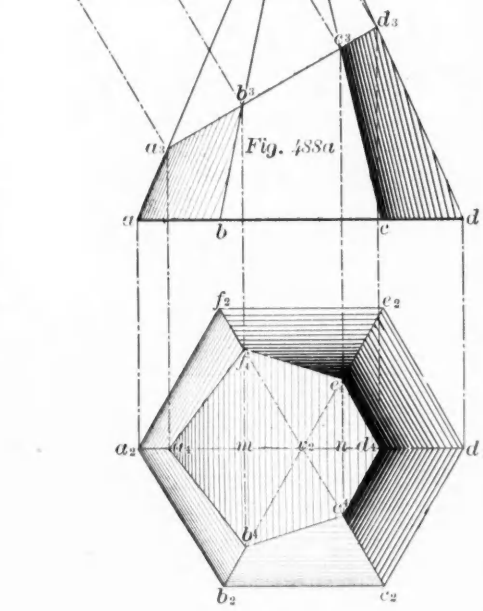


Fig. 488*a*

Fig. 488

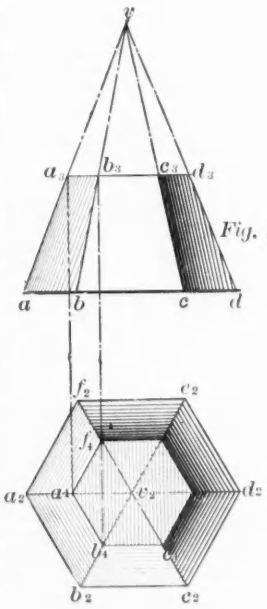


Fig. 489

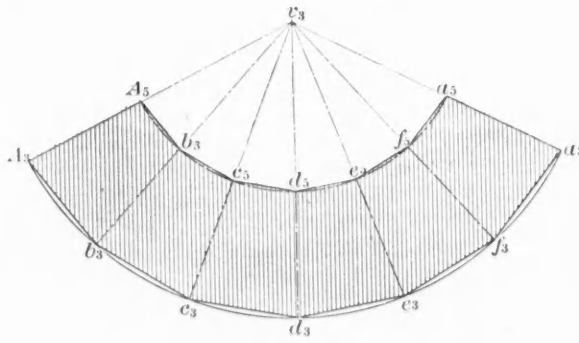


Fig. 490

589. *Caution.* The distance between the points e_3 and A_5, or that between e_3, b_5, etc., must be the true distance between these points, and since the true distance between these points can only be found on a line which represents the true length of the lateral edges of the pyramid, it follows that the distances between the points A_5, e_3, b_5, e_3, etc., must be made equal to the distance between the points e and a_2 (Fig. 489*a*) lying in the line $e\ a$, which, as we know, shows the correct length of the lateral edges.

Directions. In the space marked Prob. 89, draw the vertical and horizontal projection of a frustum of a right pyramid having hexagonal bases; the distance across corners of the lower base, that is from a_2 to b_2 is 7 inches; the length of the lateral edge $a\ a_3$, 4 inches; the distance across corners of the upper base is 5 inches. Find the development of the convex surface of the frustum of the pyramid.

590. In passing a plane through a pyramid, we obtain a section of the pyramid; hence, we may say, that the upper base $a_4\ c_4\ f_4$ of a truncated pyramid (Fig. 488) considered by itself, is called a section of the pyramid. Let us now consider the sections that can be obtained by the cutting planes passed in different directions through the pyramid.

In Figs. 488, 488*a* the cutting plane $a_3\ d_3$ is not parallel to the base $a\ d$ of the pyramid, and therefore the section $a_4\ c_4\ f_4$ in Fig. 488 will not be similar to the base $a_2\ c_2\ f_2$; that is to say, the proportions of the sides of the section will not be like those of the sides of the base, and the respective angles formed by the sides of the section and the sides of the base will not be equal. These remarks apply to all sections obtained by passing through any pyramid a plane which is not parallel to the base. Again, in Fig. 488, not one of the sides of the section is parallel to a side of the base, and, indeed, this is what we might expect on account of dissimilarity between the section and the base. But from this we must not conclude that in every section made by an oblique cutting plane not one of the sides of the section will be parallel to the sides of the base; if, for instance, we place the pyramid with two of the sides of the base perpendicular to the vertical plane of projection, and leave the cutting plane in the position as represented in Fig. 488*a*, that is, perpendicular to the vertical plane of projection, we will then have two of the sides of the section parallel to two sides of the base; but still the section and the base will not be similar, because, as before, the proportions of the sides of the section will not be like those of the sides of the base, and the respective angles formed by the sides of the section and the sides of the base will not be equal.

Some Further Uses of the Yielding of Metals to Pressure.

BY JARNO.

Some years ago I made a vernier caliper with the gib in the sliding jaw, like $A\ B\ A$, Fig. 1 (page 7).

This gib does not project beyond the slide, the ends being flush. Between the gib and the part of the slide D through which the screw goes, the space is as small as practicable, to avoid the collection of dust. Opposite the binding screw the gib is cut away, and between $C\ C$ has no bearing upon the bar. After the gib was fitted into place it was firmly held upon the bar, while the holes $A\ A$ were drilled and reamed tapering. Into these holes, pins $A\ A$ are fitted. The pins are hardened. When they are driven in, the slide is not likely to move too hard; if it does, the bearing points of the gib should be carefully smoothed, or the gib can be taken

out and its holes reamed a little. The action of this gib is to yield in the middle when the screw is set up, which brings pressure upon the bar at *C C*.

Because of the leverage *B A* over *C A*, the pressure may be several times greater than it would be if, as in some calipers, it were applied directly opposite the screw. When the screw is lightly set up the slide is rigidly held.

Several mechanics have remarked that this gib is unmechanical. The term unmechanical has rather an indefinite meaning, which, so far as I understand, is hardly other than unfashionable, or new to the one who uses the term. All combinations in mechanism that are new to Waubug Mephit, and which he did not himself think of, he calls "unmechanical." The objection urged against this gib is that it acts like a knee lever, and brings an undue strain upon the pins. This might obtain if the gib could yield to the screw indefinitely, but long before it acts perceptibly as a knee lever it rigidly fastens the slide. When shaped as in the figure, the first tendency of the gib is to lengthen the distance between the holes, when pressed by the screw. By hollowing the gib upon the screw side, the tendency to lengthen or shorten can be varied; but such a refinement is not needed.

A slide fitted up as in Fig. 1 is not loose on the bar when the screw is turned back; the screw has no tendency to change the setting of the slide, because the pins *A A* prevent any end movement of the gib; a slight turning of the screw is enough to clamp the slide; the slide is rigidly clamped at both ends, and dust does not fill in around the gib.

Fig. 2 illustrates a principle used by Mr. Corliss for fastening the screws that adjust the side pillow boxes in one of his later engines. In the set screw *E* is a tapering hole into which another screw *F* is fitted. Slots are cut through into the hole. Three slots are well enough. After the boxes are adjusted the taper-pointed screws *F* are set up, thus expanding, and firmly fastening the set screws. By the same principle, the screw *H*, Fig. 3, will fasten any piece upon the shaft *J*. Though this fastening may not be so firm as a key or a set screw, yet it is sufficient for most purposes. It is expensive, yet its convenience sometimes pays the extra cost. If *L* be a worm whose end thrust is taken by the boxes *K K*, a key or set screw is not always easily applied. A key prevents rotary slipping, but it may not prevent lengthwise slipping. Fig. 3 is equally efficient to hold in either direction; the parts can be quickly assembled or taken down. To this combination the objection is made that the shaft is likely to be sprung out of true when the screw is set up. I do not think this has been found in actual use. This combination, like the vernier caliper slide, Fig. 1, must be well made. The difference between a tight and a loose fit being so very little, we can have a shaft so nearly the size of the hole in the hub, that, even though the shaft spring altogether in one direction in being spread to fill the hole, yet it would not be much out of true. The slots should be cut before the shaft is finished to size, because the cutting of the slots may spring the shaft. I have seen a lathe whose change gears are held on by a method of the same principle as Fig. 3, the end of the spindle stud and the end of the leading screw being split; but rotary slipping is prevented by two pins that are fastened into the shoulders against which the gears bear. The pins are parallel to the axis of the spindle stud or leading screw. Two holes parallel to the center hole are drilled through the hub of each change gear. The pins in the shoulder of the stud or leading screw go into these holes. Workmen like this method of fastening change gears, because the gears can be so quickly put on or taken off. A lathe made later, from the same patterns, does not have this method of fastening the change gears, but has gone back to the key and nut.

If I were buying a lathe for my own use I would pay more than the difference in cost for the first one. I made an experiment to learn how hard the gears in the first lathe could be held by friction alone, or without the pins. A gear on the spindle stud held enough to make a 2″ belt slip on a cone step 7″ diameter, the gear having a ⅜″ hole.

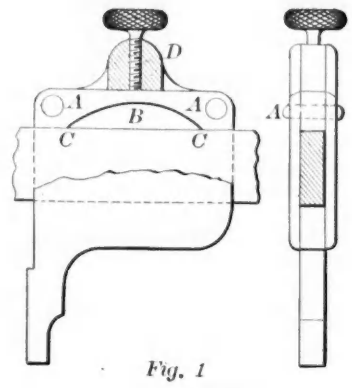


Fig. 1

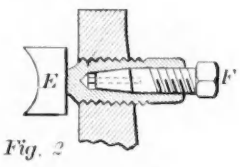


Fig. 2

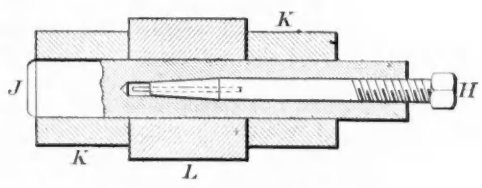


Fig. 3

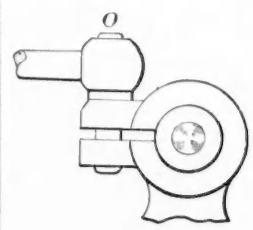


Fig. 4

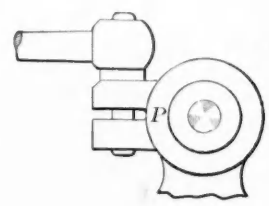


Fig. 5

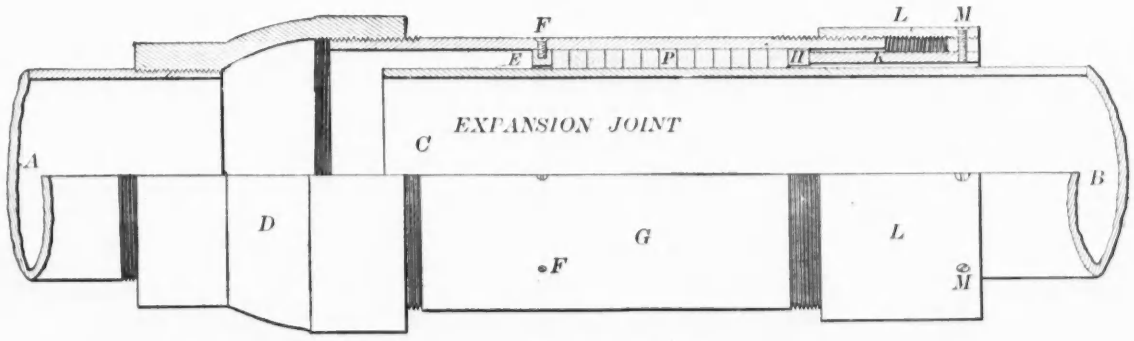
YIELDING OF METALS TO PRESSURE —SEE PAGE 6.

I did not think it safe to make any harder test.

It is not many years since the method of clamping a foot-stock spindle shown in Fig. 4 was a surprise. The question was asked, "How can a stiff bushing or sleeve, with a slot into the hole at only one end, be made to clamp a spindle as firmly as a yoke that goes around the spindle and clamps it by being screwed up against one side?" It is said that the machine designer who first introduced this method of clamping met with strong opposition from the concern that employed him. He insisted upon the adoption of his method, and, upon meeting with further opposition, threatened to leave the concern's employ. A few lathes having this feature were sent out, but not before its general adoption by others did this concern apply it to all their lathes. In truth, a more rigid fastening could not well be devised. It has something of the character of what Prof. Willis calls coil friction.

Put an arbor into the lathe; fasten one end of a cord into the tool post; wind the cord half way round the arbor and hold the free end in one hand; with the other hand rotate the arbor so that the cord will pull on the tool post. Taking the mean value of friction at one-third of the pressure that generates it, Prof. Willis says it can be shown that any tension upon the free end of the cord while the arbor is turning produces a tension three times as great upon the fast end. If a whole coil of the cord be taken, the tension upon the fast end will be three times that made by the half coil; that is, the fast end pulls nine times as hard as the tension upon the free end. If an additional coil be taken, the tension upon the fast end will be eighty one times that of the free end. That which resists the slipping of any flexible piece when wound upon another is called coil friction. The friction between two flat surfaces is not changed by increasing or diminishing the surfaces, so long as the pressure remains the same. Coil friction can be increased by simply taking more coils. Taking the co-efficient of friction at one-third, each additional coil multiplies the friction of all the previous ones by nine. The co-efficient of friction, it will be remembered, is the ratio of the friction to the pressure that generates it. For hemp or leather upon wood, or between two pieces of wood, the co-efficient without lubrication is about one-third. For example, if a piece of wood weighs three pounds, a pressure of about one pound will move it, when it is upon another piece of wood, the bearing surfaces being smooth and level. The co-efficient of friction between two metals when oiled is commonly taken at about one-twelfth or one-fourth that of wood on wood. With oil the friction of hemp or leather upon metals is about the same as that between metals. In a late experiment, each coil of a cord upon a smooth steel arbor, very slightly oiled, increased the friction to something more than two times that of all the previous coils. This is conveniently shown by fixing an arbor or cylinder so as to prevent its rotation, and suspending unequal weights to the respective ends of a cord passed over the cylinder. With a half coil the large weight must be about 1½ times as heavy as the small weight, before the small weight may be drawn up. With 4½ coils the small weight may be drawn up by one 27 times as heavy. It would appear that Fig. 4 is a case of coil friction in which there is one coil, and that the screw *O* will act to hold the spindle about three times as hard as it would if employed in clamping upon two sides of a parallel piece.

I think that the device for clamping shown in Fig. 5 would work well. It is, in outline, much like Fig. 4, but there is no slot into the hole. This device can be applied at both ends of a foot-stock spindle. In setting up on the screw the lugs will give and bring clamping pressure at *P*. Not to have a slot into the hole may be an advantage. Mephit says this device will not work well. I do not think it will until it is tried.



LETTERS FROM PRACTICAL MEN.

Expansion Joint.

Editor American Machinist:

The expansion joint illustrated herewith may be used on a six-inch pipe for supplying steam for heating a building. It is recommended for low first cost.

The coefficient of expansion of wrought-iron being 0.000007 per degree Fahr., a pipe 500 ft. long will expand

$$500 \times 0.000007 = 0.0035 \text{ ft.},$$

or, 0.042 inches for each degree rise in temperature. The difference between the lowest temperature of a pipe buried below the frost line and the highest temperature of steam used for heating, is about 200° Fahr. Hence the total expansion will be

$$0.042 \times 200 = 8.4 \text{ inches.}$$

A is a 6-inch wrought-iron pipe tapped into the increaser *D*. The increaser is also fastened to a length of 8-inch pipe marked *F G*. *B C* is a 6-inch pipe expanding freely into the casing *F G*. A forged ring *E* is secured to the outer casing by machine screws *F F*. *P* is the packing. *H* is a loose ring resting on the packing, and affording a footing for the short length of 7-inch pipe marked *K*. An ordinary coupling *L* screws onto the casing *F*. To this coupling is fastened the pipe *K* by means of the screws *M*, *M*, and the spacing ring between them. By turning *L*, *K* is also turned, but the ring *H* prevents the packing being damaged. The gland can, of course, be made differently. The illustration is in one-half section, and one-half elevation.

Fayetteville, Ark. PROF. J. M. WHITHAM.

Drafting Room Practice.

Editor American Machinist:

I wish to express obligation for many useful suggestions contained in your lately published letters on drafting room practice and system.

For securing accuracy in a drawing, nothing, I think, can take the place of constant watchfulness and comparison, one thing with another. A method, however, that has proven of much use to me, is the practice, while making the pencil drawing, of putting on the figures as I go along, that is, when a measurement is laid off and the line drawn, the dimension line and figure should be put down at once before the attention is diverted. These figures should then be used in building up the drawing and making comparisons in preference to the more common practice of using a scale to ascertain dimensions. When finished in this way the drawing is complete in itself and may be traced and the figures copied by another.

F. G. H.

Finish of Piston Rods.

Editor American Machinist:

Though I fear it may seem somewhat like a piece of foolhardiness for me to differ upon a point of practice from one who evidently thoroughly understands his business, as Mr. T. T. Parker's letters prove that he does, yet I cannot forbear offering a few remarks upon a subject introduced by him in his last letter in relation to smoothing the surfaces of piston and pump rods which have become scored.

Mr. Parker advocates draw-filing, or finishing lengthwise with emery cloth, and though I am well aware that this is in accordance with almost universal practice, yet I do not think it is right. My attention having been first called to this matter by an article of Chordal's some years ago, wherein he attacked this practice, I have tested the matter practically a great many times since, and have universally found the best results to follow from filing or otherwise finishing a rubbing otherwise than with the direction of its motion. So thoroughly convinced am I of this, that I believe the best way to finish revolving journals is in the manner that piston rods are now generally finished, and that piston rods should be finished as journals usually are. I remember that Chordal, in speaking of this subject in the article to which I have alluded, brought up the case of engine cylinders, and said that if they were finished lengthwise or parallel with the motion of the piston nearly every one of them would be badly cut in starting the engine, and I believe it. This is a subject which will well repay investigation by mechanics, and I should like to see the views of others who have had experience in the matter published in the AMERICAN MACHINIST.

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Standards.

There is, in the United States, an increasing agitation in favor of standard dimensions for articles of manufacture. The outcome of this agitation will be, beyond much doubt, that eventually very many things that are now made by one manufacturer, without reference to how another makes them, will be made by all manufacturers practically alike; that is, alike so far as the construction that permits of the use of one in place of another goes. This, in the instance of many small articles of manufacture, and in the component parts of many machines of common use, is certainly much to be desired. The bringing of this about will be a somewhat tedious operation, but this is saying nothing against the effort.

As against the easy accomplishment of getting to standard sizes is, the objection of manufacturers to making the things they manufacture interchange with those made by other manufacturers. There is the desire, with which no fault can be found, to "hold the trade," and the reasoning of the manufacturer is, that if the similar product of another will not take the place of his without involving serious trouble and expense, the customer will come to him when renewal is necessary. This may apply to a whole machine, or to any of its parts, as in the instance of a machine set on a solid and expensive foundation, or in the cylinder of a steam engine. (This last illustration is made, because it is a familiar one, and not because cylinders of steam engines are likely to be made to standard dimensions, at least not during this generation.) But such reasoning is not strong. With a desire to retain his own customers, every manufacturer has a desire to get as many new ones as he can, so that with such machines, or parts of machines, as are of common manufacture, there is quite as likely to be as much loss as gain in refusing to conform to standard.

This is probably the view of a majority of manufacturers at the present time, but the objection referred to has been strong in its day. Before the adoption of the standard screw thread, a manufacturer of machinery that found a sale all over the United States and in many parts of Europe was using, on some of his machines, long and costly screws cut with a pitch of such an exceptional fraction that there was no probability of duplicating it in other shops, without making gears for the purpose. The presumption was that when the screws were worn out, or the nuts, as to that matter, they would be replaced from the shop where they were originally made, and this was so, to a considerable extent at least. Moreover, with especial short-sightedness, he made small tap bolts that it was equally vexatious to reproduce elsewhere. We note only one manufacturer, because all the circumstances are within our knowledge. He was probably not the only one who adopted that plan. This particular manufacturer is out of business, and his place at least is not filled by another. He strenuously objected to standard threads—or any even number of threads or respectable fractions—because, as he thought, it would seriously interfere with his business. There is at least one evidence that a different opinion prevails now, in the fact that, when the standard pipe thread was proposed by the American Society of Mechanical Engineers, the manufacturers of pipe and pipe fittings were anxious to adopt such a standard as should be agreed upon.

Another objection of greater weight is the honest convictions of manufacturers. Those in a certain line of manufacture, that it is of importance to standardize, may, and are very sure to disagree, and when their number is large the difficulty of the task of getting them to surrender their convictions is apparent. Still, it is by no means evident that it is impossible to do so if there is a demand for it by those who use their products. The establishment of one standard is a help towards the establishment of others.

Another objection—and one not easily set aside—is that the setting up of a standard to a great extent bars progress in that direction. It is always easier to get into a rut than it is to get out of it. Progress is a thing of degrees, usually, a little being added here and a little there, and very generally as the manufacturer sees the necessity—in order to keep his trade—of moving ahead. It can hardly be denied that, with a standard once adopted, he will have little incentive to break away from it unless the change is one of great importance. Indeed, quite the contrary is true; for customers once accustomed to a standard will not follow the single manufacturer unless his improvement amounts to something like a revolution. While this is not an argument against the adoption of a standard in any particular instance, it is, we think, valid against hasty action, or action in any case unless it is apparent that progress is not imminent.

We make no argument against standards, fully believing in them as fast as development will justify. But standardizing articles of manufacture is something that should be done with due deliberation, or more harm than good may be done. In the meantime, agitation of the subject is almost certain to result in good.

German Copying.

A friend sends us a copy of the catalogue of Ludw. Loewe & Co., of Berlin, an inspection of which shows that the firms who depend upon American machine tool builders for their ideas and designs are by no means confined to England. The frontispiece on the title page of this catalogue is a rough engraving of what is practically Brown & Sharpe's universal milling machine; and of the many engravings presented in the catalogue (which has 143 pages), there are comparatively very few which are unfamiliar to Americans, and which are not evidently made from machines that are very close if not exact copies of well-known American productions.

Pratt & Whitney are most fully represented, there being at least thirty-five cuts which strongly resemble those to be seen in their catalogue, and are evidently made from machines copied from their designs. There are also quite a number of Brown & Sharpe's and the Stiles & Parker Press Company's productions shown, and altogether we should judge that an American mechanic going into a foreign shop, equipped from the establishment of Ludw. Loewe & Co., would feel very much at home so far as the general appearance of the tools could make him feel so. Of course we cannot say how the workmanship compares with that which is found upon the original machines which are built in this country, but if it bears any direct relation to the quality of the engravings shown in the German catalogue, the workmanship of the American machines must be far superior, as we have other reasons for believing that it really is.

Of course it is gratifying to find that the work of American engineers and tool builders meets with approval in foreign countries, but we should prefer to see this approval manifested in some other way if possible. The existence of such catalogues as this, and the one which we referred to a short time since, demonstrate that there is a good demand for American tools abroad, and it is probable that, if the genuine American machines were furnished, this demand would largely increase. .

The "Vorwort" of this catalogue says: "The progress of our industries points to the concentration of wholesale manufacture. With this object in view it is desirable on the one hand to make specialties of different branches, and on the other hand to make specialties of manufacturing separate articles in large quantities, and for this purpose to devise automatic methods for the manufacture of large quantities, which will not only insure quantity, but also quality of execution. It is this expedient the American industries were forced to adopt through foreign relations, which has been from the beginning a great advantage to them; and yet it has been adopted only to a very slight extent by the leading establishments on our continent. We have now made it our task to furnish machines and tools for the purpose, which, in regard to quality, will compare well with the American production."

Just what is meant by our having been forced to adopt systematic manufacture by means of high grade automatic machinery we do not know; but the above translation from their introduction, and the fact that they elsewhere refer to their products as being constructed upon the American system, shows that the "American system" is very well thought of there, and that Ludw. Loewe & Co. are fair enough to give the country from which their designs came some recognition and credit for them.

Henry C. Parsons.

Mr. Henry C. Parsons, of Newark, N. J., died Wednesday, the 19th of June, at Flemington, N. J., where he had gone on account of failing health, he having been ailing for about three years with diabetes, though he continued to attend to business affairs until about the first of the present year.

At the time of his death, Mr. Parsons was fifty-six years of age, and held the position of superintendent and general manager of The Watts, Campbell Co.'s establishment at Newark, he having been connected with that establishment since 1859 successively as journeyman machinist, foreman, superintendent and partner. In 1880 he sold out his interest in the concern, and took a position as superintendent of the U. S. Electric Light Co., returning three years later to take the place of general manager, made vacant by the death of Mr. William Watts.

Mr. Parsons owed his success in life to his own ability and conscientious devotion to duty. Born on a farm in New Jersey, he knew in his younger days the meaning of hardships and deprivation, but being a natural mechanic, he at an early age went to Newark and served an apprenticeship to the machinist's trade, and, thoroughly mastering it, kept on until he became recognized as an engineer of uncommon ability, taking a great interest in the literature of his profession, and sparing no pains to keep well abreast of the times. He had recently traveled extensively in Europe, studying matters pertaining to engineering, especially multiple-cylindered engines.

Personally, Mr. Parsons was a man who was universally esteemed and loved by those who came in contact with him, and he had acquired the name of being a large-hearted man. To quote the words of one of his partners, who had been intimately associated with him for thirty years: "Mr. Parsons cannot be too highly spoken of as an engineer and as a man; he thoroughly understood his business, was entirely reliable, and his knowledge, pocket-book and everything he possessed in the world were for the benefit of his friends, or those who needed his assistance." To such words of praise from one who had enjoyed every opportunity of being thoroughly acquainted with the man, it is difficult and indeed superfluous to add anything of significance.

QUESTIONS AND ANSWERS

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(266) T. W. S., ——, asks: Which is the most accurate place to set the guide lugs on a locomotive—should they be fastened to the cylinders or the frames? *A.*—In all modern American locomotives, the front end of the guide is fastened to the cylinder head, and the rear end of the slide is fastened to the guide yoke.

(267) E. S., Cohoes, N. Y., asks: Will you please describe a compound engine? Or if you have already published a description of the same, please name the paper. *A.*—See articles on the compound engine, commencing in our issue of Feb. 25, 1888; also, description of a compound engine in our issue of Nov. 24, 1888. Besides the foregoing, we have given from time to time descriptions of a number of other compound engines.

(268) C. M., Yonkers, N. Y., asks: Please inform as to what size air pump I will require for an engine 38½x59½x9 inches, stroke, 6 inches, revolutions, 400, boiler pressure, 150 pounds. *A.*—For so small an engine we should make the air pump capacity equal to ⅛ to 1-9 of the capacity of the low-pressure cylinder. See answer to Question 226 in our issue of May 23, 1889. 2. What do you think of the given proportions? *A.*—They may answer your purpose, but for engines of the size given, we believe that a two-cylinder compound engine will do the work just as well as a triple expansion engine.

(269) C. W. T., ———, writes: Please give me the best process for bluing steel? *A.*—The best process will depend upon the nature of the pieces to be blued, and the object of the bluing. It is usually done by heat, and if the pieces are small enough to admit of it, they can be put into an iron vessel containing sand and heated, while at the same time the vessel is kept in motion in order to keep the heat evenly distributed throughout. If the pieces are too large for this, they may be heated uniformly by Bunsen burners, or upon a heated plate, until the desired color is produced. The higher the finish, the brighter the color will be

(270) "Plug Gauge," ———, asks: Will you please inform me 1. How I can temper twist drills the entire length from ¼" to 1½" diameter, and have them straight? *A.*—We do not think there is a way of insuring that every one will come out straight, but those which do not are straightened after tempering. The springing can be very much reduced by care in heating, but it is chiefly a matter of skill, which must be acquired by experience. 2. Is there a process by which I can swell and re-grind to size a reamer or a plug gauge that has become too small? *A.*—In our issue of June 2, 1888, a method of increasing the size of reamers is given, but we know of no method for plug gauges.

(271) J. W. R., Granger, Texas, writes: Please give me a rule for setting the eccentric on a common straight line engine 8x12 inches cylinder, cuts off at ⅝ of the stroke. Should it have lead: and how much? *A.*—Lead about 1-32 of an inch. One rule for setting the eccentric has been given in our issue of October 24, 1885. 2. Please give a rule for babbitting that portion of a crosshead which works between the guides. *A.*—A rule covering every case cannot be given; the form of the crosshead should indicate to you the course to follow, if you meet with any difficulties, then write to the makers of the engine. 3. Have you shown the different cut-offs of an engine? *A.*—If you mean the amount of lap required for any given cut-off, then see our issues of Nov. 21 and Dec. 12, 1885.

(272) J. L. O., Cooney, New Mexico, asks: Would you kindly inform me under what conditions lead is required in a steam engine, and when not? *A.*—Lead is required in all engines, especially with high-piston speeds and low-pressure steam; it assists the compression and maintains the full initial pressure as the piston moves forward. If no lead be allowed, the valve is not sufficiently open when the piston begins to move forward, and the full pressure of the steam does not come upon the piston until it has traveled over a part of the stroke. Rules for obtaining the exact amount of lead for all cases cannot be given; and after an engine has been built, it may be necessary to determine the lead experimentally by gradually increasing the angular advance of the eccentric until some position is found which results in a smooth and noiseless movement of the reciprocating parts.

(273) J. J. M., Mobile, Ala., asks: What questions will I have to answer to get out papers for running a locomotive? I have had several years of experience in machine shops and understand running stationary traction engines. *A.*—Before you can obtain a locomotive engineer's license, you must have experience in firing a locomotive. The questions asked during an examination are not fixed, but they will be such as to test your knowledge of the running and management of a locomotive. In many States you will not require a license, and you will be obliged to work as fireman until the authorities of the road consider you competent to run a locomotive. The best way for you to pursue is to engage as fireman, and in the meantime read books and papers treating on the locomotive, so as to enable you to answer any question which the board of examiners may ask.

(274) H. L. W., Chicago, Ill., writes: Can you give me any information regarding the Westinghouse air brake? I want to find what amount of pressure there is brought to bear on the piston which works the lever connected to the brake beam. And how much pressure is there on the brake shoe? *A.*—We have submitted these questions to the Westinghouse Air Brake Co., who have kindly sent us the following reply: The pressure upon any piston, regardless of its size, should be that derived from 70 pounds pressure in the auxiliary reservoir. This pressure, with the old brake, will be 50 pounds per square inch on the piston, and with the new quick-action brake, when quick action is had in emergency stops, 60 pounds. We recommend a braking power equal to 90 per cent. of the weight of passenger cars at the track under the wheels to which the brake shoes are applied, and 70 per cent for freight cars.

(275) W. D. R., Pueblo, Col., writes: Please give rule for finding the weight that can be lifted by a screw, or the tension that can be given a bolt or stud by using a wrench to the nut. *A.*—Find the distance moved by the power (or the hand) in one complete revolution of the wrench; divide this by the pitch of the screw, and multiply the quotient by the power applied. This will give you the theoretical amount of strain, from which must be deducted a certain amount for friction; this will vary somewhat, but for ordinary cases may be taken at 70 to 75 per cent. 2. I have always used as a rule one-fourth diameter of shaft for width of key-way. Is this right? *A.*—It is a very generally used rule, and may be considered about right for most cases. Some add ⅛ inch to all sizes. 3. I would like a rule for depth of key-way in shaft and in a pulley or disk. *A.*—The usual practice is to make the key square with half its thickness in the shaft. For crank disks, the key is often made wider than its thickness, though no strict rule is followed regarding it. The book you speak of is published by Chas. Scribner's Sons, New York.

(276) H. H., Brooklyn, N. Y, writes: In our place we have several heavy pumps, working sometimes from 4 to 6 weeks without a minute's stop. All are fitted with common oil-cups got out of some old scrap heap. The well pump 12"x36"x9" has the same size oil-cup as the little tank pump 4"x6". In order to reduce the mileage I have to make every night by going around oiling, I have the idea to fit them with sight feeders. The firm do not buy any, so I will have to make them, and propose to do so as per enclosed sketch. The question is: Will this oil cup work? An answer will do me a great favor, as we have not many minutes to spare out of our 12 hours for experiments, and possibly work against nature's laws. *A.*—You will only have a partial success, as the oil will run out of the cup too quickly. You have closely followed the principles of self-feed lubricators now in use, yet in one very important point you have lost sight of these principles. We cannot explain this satisfactorily without reproducing your sketch in these columns, and such will take up too much room. If you will compare a sight-feed lubricator with your arrangement, and remembering the hint we have given, you will not have any difficulty in perceiving the changes required to make your arrangement work successfully. It may also be well to mention that many sight-feed lubricators are patented, which may prevent you from using the arrangement you propose. It seems to us that the owners should be interested enough in the working of these pumps (saying nothing of duty), to attach to these the best lubricators, at their own expense, that can be found in the market.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue

Gear wheels and g-cutting. Grant, see adv., p. 16

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y.

$100 Reward, page 14.
$100 Reward, page 14.
$100 Reward, page 14.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

20" Upright Drills. J. E. Snyder, Worcester, Mass.
23" Upright Drills. J. E. Snyder, Worcester, Mass.
25" Upright Drills. J. E. Snyder, Worcester, Mass.
28" Upright Drills. J. E. Snyder, Worcester, Mass.

Small Speedy Drills, Am. Tool W'k's, Cleveland, O.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

R. Dudgeon, 24 Columbia st., New York. Improved Hydraulic Jacks and Roller Tube Expanders.

The Improved Justice Hammer. Williams, White & Co., Moline, Ill., manufacturers.

Hand, Nut, Taper and Pulley Taps. S. W. Card & Co., Mansfield, Mass.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortland st., N. Y.

Best silk wiping towels for machinery in the market. S. A. Smith, 23 S. Canal st., Chicago, Ill.

Ice and Refrigerating Machines, 131 sold, and all successful. David Boyle, 5-1 Monroe st., Chicago, Ill.

Iron Planers from 16" to 36" wide by any length. H. C. Pease & Co., Worcester, Mass.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See June 20, p. 15. Send for circular No. 17 Curtis Reg. Co., Boston, Mass.

The best emery wheel made is the "Norwich." For particulars send to Montgomery & Co., 105 Fulton st., New York.

For the latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

The hook on steam engines is being supplanted by the Dill disconnecting device, made by the T. C. Dill Machine Company, 726 Girard ave., Phila., Pa.

Most sensitive and durable Damper Regulator made; works within one pound; send for circular. T. Kieley, 11 W. 13th st., New York.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

W. H. Hoffman, consulting engineer, 108 Liberty st., room 3, N. Y. Mechanical engineering in all its branches, working drawings for the transmission of power by steam, water, air and electricity.

Contract work of all kinds executed promptly and on reasonable terms. Parties wishing grey iron castings in large quantities can make money by corresponding with Rawson Mfg. Co., Hornellsville, N. Y.

Steam Boilers: Their management and working on land and sea. By Jas. Peattie. Practical facts from 30 years' experience. 230 pages illustrated, 12mo., cloth, $2. Circulars and Catalogue of Books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N.Y.

Patterson, Jordan & Gottfried, 146-150 Centre st., N. Y. Metals, Machinery, Hardware, Tools and Supplies for Machinists, Mills, Engineers, Brass Goods Mfrs., Factories, etc. An extensive assortment of Bolts, Screws, Wire, Taps, Drills, etc., carried in stock.

Patent or shop rights for sale, for perforating iron or steel plates for steam boilers, bridge work, iron or steel ship work, marine boiler heads, equal to drilled work and fifteen times quicker. Samples can be seen and circulars obtained from R. E. Dietz, 60 Laight st., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c each. The former has stiff board covers, while the latter has flexible covers, with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

"Practical Drawing." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1885 issue, and up to and including May 23, 1889 issue, 77 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

"Modern Locomotive Construction." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world Commencing with the June 27, 1885 issue, 92 articles have thus far appeared up to and including the May 30, 1889 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada, at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

MANUFACTURES

Aldrich & Milner are building a new mill at Massup, Conn.

A saw mill will be erected at Level Green, Ky., by Warman Bros.

The flour mill of W. H. King at Bowman, Ga., is to be enlarged.

The Cheshire Shoe Co are about to erect a factory at Pittsfield, Mass.

At Hogdensville, Ky., L. L. La Rue intends to build a planing mill.

A large saw mill is to be built at Jacksonville, Fla., by H. S. Wilson.

At Paterson, N. J., the Paterson Ribbon Co. will build a mill 30x300 feet.

The Belfast Shoe Manufacturing Co., of Belfast, Me., will enlarge its factory.

Eutawville Railroad Co. have secured a site for a machine shop at Sumter, S. C.

The Electric Welding Co., of Lynn, Mass., will build an addition to their factory.

A ten-set woolen mill is being erected at Providence, R. I., by Sampson & Sheridan.

A comp any is being organized at Carrollton, Ga., by R. Thomas, to build a paper mill.

A saw mill will probably be erected at Buffalo Valley, Tenn., by Bartlett, Sutton & Co.

There is talk of the Huber Printing Press Co., of Taunton, Mass., locating at Westerly, R. I.

The Tampa Lumber Co intend to add sash, door and blind machinery to their existing plant.

A machine shop will be built at Washington, D C., by the National Mould and Stamping Co.

Machine shops will be built by the Missouri, Kansas & Texas Railroad Co. at Alvarado, Texas.

Additional machinery is to be put into the shops of the Brunswick Machine Works at Brunswick, Ga.

A large addition is being built to the plant of the Woodward Sash, Door and Blind Co., at Atlanta, Ga.

Efforts are being made by B. M. Turner, at Barnesville, Ga., to organize a company to build a flour mill.

The business men of Eastport, Me., are holding out inducements for the location of a shoe factory there.

The Atlanta Machine Works, Atlanta, Ga., have started in operation after an idleness of several months.

The Memphis & Chasston Railroad Co. are about to let contracts for the building of machine shops at Sheffield, Ala.

Work is soon to be commenced on the machine shop of the Atlantic & Danville Railroad Co., at Portsmouth, Va.

At Elberton, Ga., a stock company has been organized, to build a cotton mill. J. W. McCalla is secretary and treasurer.

The Ross-Mehan Brake-Shoe and Foundry Co. of Chattanooga, Tenn., contemplate the addition of a machine shop to their plant.

It is reported that a portion of the bolt factory at Hartford, Conn., is to be used for the manufacture of graphaphones, and that 1,000 hands will be employed.

The Globe Rink, at Haverhill, Mass., has been purchased by J. H. Winchell & Co., who will equip it with steam power and machinery for the manufacture of shoes on a large scale.

The Electrical Review Publishing Co., 13 Park Row, New York, have issued a catalogue of American and foreign books on electricity, and of the scientific works published by the company.

The Howard Iron Works, of Buffalo, N. Y., it is reported, are negotiating for the purchase of Nicol, Burr & Co.'s plant at Peoria, Ill., and, should they purchase, it will be enlarged considerably.

The works of the Johnson Switch Co., which were destroyed by the Conemaugh flood, will be rebuilt on a large scale at Moxam, which is three miles up the stream, and not liable to be flooded.

The building of new or enlargement of existing water-works plants is being considered at De Land, Fla.; Athens, Ga.; Milledgeville, Ga.; Waycross, Ga.; Rock Hill, S. C.; Knoxville, Tenn.; Laredo, Texas.

The P. C. Holmes Co., of Gardiner, Me., which has recently been considering the advisability of moving its plant elsewhere, has decided to remain in Gardiner, and has bought land on which a new foundry will be erected.

The corner-stone for the first building of the Williams Engine Works was laid June 21 at Beloit, Wis. This structure will be 88x145 feet, and is located about 100 yards west of the plant of the Eclipse Wind Engine Co.

The Springfield Machine Tool Co., of Springfield, Ohio, have leased the plant formerly occupied by the Hanika Iron Fence Co., and are moving into it, their present quarters having grown too small for their increasing business.

What is said to be the largest production of pig-iron in a single week from one furnace in the Lehigh Valley was turned out from Stack No. 3, Allentown Iron Works, Allentown, Pa. 630 tons were produced, 50% of which was A 1 Foundry.

A $300,000 stock company is being organized by the Fort Payne Coal and Iron Co., to build a cotton mill at Fort Payne, Alabama, and the North Fort Payne Land Company are organizing a company with $150,000 capital, to build another mill at the same place

The Pond Engineering Co., St. Louis, Mo., have issued a pamphlet specially devoted to pumping machinery for the water-works of small cities and towns. Its pages contain perspective and detail cuts of small and medium-sized direct-acting pumping engines, suitable for such service, besides boilers, feed-water heaters and purifiers, and other apparatus used about the engine house of a water-works.

The Buffalo Forge Co., Buffalo, N. Y., have issued a very attractive catalogue, showing the application of their blast and exhaust fans, and other appliances, to the heating and ventilation of all kinds of buildings. Besides illustrations of the machines used, there are numerous diagrams of the shops and other buildings, showing the arrangement of pipes, etc., which make the catalogue valuable to those interested in the subjects to which it relates.

It may be considered remarkable, and it will doubtless create some excitement and perhaps dismay among the paper makers of Great Britain, to learn that an English journal of importance has offered to contract with one of our leading American manufacturers of paper for its supply of paper for one year. This offer results from a trial of the paper, and is an earnest of the fact that we are able to produce goods which, as to quality and to price, will meet the competition of foreign manufacturers, even on the latter's own ground. Nor is this likely to be the only instance of such a contract, for it is intimated that one more is pending, and that still another English journal is ready to use American paper.—*Engineering and Mining Journal.*

The present year thus far has been an exceedingly active one among carpet manufacturers in Philadelphia. Mill owners estimate that this year's business will exceed that of any previous year by at least $2,500,000. Every mill in the city is pushed to its utmost capacity, and over 300 new looms have been put in operation. One hundred and fifty mills represent a capital of $10,000,000, and for 1889 it is expected that they will turn out $27,000,000 worth of carpets. Wages amounting to $5,250,000 are given yearly to 15,000 operatives. It is said that better and cheaper carpets can be made in Philadelphia than in England or any of the great carpet factories of Europe. Extensive preparations are being made to increase the capacity of a large number of mills to accommodate increasing business.—*Boston Journal of Commerce.*

It is reported that the stockholders of the Glen Mills, a corporation recently organized at Fall River, propose to erect a cotton factory on a new plan. Instead of building layer upon layer, and department over department, as is the custom, the plant is going to spread out on the ground. A one-story structure fitted with a monitor roof is to be reared, and the spinning, weaving, carding, etc., will be located on one floor. The building will be unusually wide, and so constructed as to admit light from above. It will be furnished with 25,000 spindles, and the estimated cost is much cheaper than the average factory of the same producing capacity. The advantages to be derived are claimed to be similar to those in woolen mills of this kind, and the experiment will undoubtedly be watched with interest. A meeting of the corporation will be held this week to perfect arrangements.—*Manufacturer's Gazette.*

Machinists' Supplies and Iron.

NEW YORK, June 29, 1889.

Iron—American Pig.—The tendency toward higher prices noted last week has developed into what amounts to a regular advance of all grades, since the Thomas Iron Company have announced that after Monday next the prices of foundry grades for July and August deliveries will be advanced 50c. per ton. There has been a considerable increase in consumptive demand, and the general tone of the market is decidedly firmer. We quote Standard Northern brands, No. 1 X Foundry, $16.50 to $17.50; No. 2, $15.50 to $16. Southern brands, No. 1, $16 to $16.50; No. 2, $15 to $15.25.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—By first-class machinist, situation as foreman of general machine shop. J. A., AM. MACH.

Wanted—Situation by an experienced pattern maker; Canadian. Pattern Maker, AM. MACHINIST.

Wanted immediately—A first-class lathe man on heavy work. Ingersoll-Sergeant Rock Drill Co., 289 Ninth ave., N. Y. City.

Wanted—First-class pattern makers; steady work and good pay to the right men. Address Davenport Foundry & Machine Co., Davenport, Iowa.

Machinists wanted, for high grade machine tool work. First-class men wanted; state age, exp., etc. Address Gisholt Machine Co., Madison, Wis.

Wanted—Machinist; a skillful hand on chuck work; good wages to an A 1 mechanic. Address with reference, Metric Metal Co., Beaver Falls, Pa.

Wanted—A pushing, practical and exp'd foreman for foundry; light and heavy work. Address, with age, ref. and exp., Energy, AM. MACHINIST.

Agency or opportunity as salesman wanted by gentleman with tech. education and long exp. in the manufacture of mach'y. Agent, AM. MACHINIST.

Wanted—Metal pattern maker for light, accurate work; good wages to a thoroughly competent man. Address with reference, Metric Metal Co., Beaver Falls, Pa.

Wanted—Foreman - an energetic and wide-awake man, to take charge of an iron foundry; one who understands a foundry in all its details. Address Foundry Foreman, AMERICAN MACHINIST.

Wanted—A thorough mach'st, capable of handling men to good advantage, to invest $4,000 to $5,000 in a well-paying mach. business. Rare chance for enterprising young man. Enterprise, AM. MACH.

Wanted—An active and persevering man of good character to travel and solicit orders for steam engines and general machinery. Address, stating age, experience, and salary expected, Homo Ferro, care AMERICAN MACHINIST.

Wanted—A machinist in Chicago to take charge of the manufacture of a small specialty; must have a faculty for doing good work systematically. Give reference, experience, age, wages, etc. Box 109, AMERICAN MACHINIST.

Wanted—A first-class machinist for fine planer and lathe work; good pay and a steady job for a man faithful to the interests of his employer, and capable of doing satisfactory work. Address No. 841, AMERICAN MACHINIST.

Wanted—By a foundry and machine works with rapidly growing trade, a thorough moulder or machinist with from $3,000 to $5,000, to take an interest in the business, and act as foreman; must be a thorough mechanic. Address R. J., AM. MACHINIST.

Wanted—A mechanical foreman, by a responsible manufacturing company in Conn., to take charge of their machine shop and brass department for the manufacture of steam and gas fitters' and steam users' supplies and tools; must be a good general mechanic of ability, with experience in these or similar lines, capable of designing tools for cheapening costs, and skilled in managing help. Address, stating particulars, Box 108, AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Cheap 2d hand Bolt Cutters. S. M. York, Clevld., O.

Just out; aluminum-steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, O.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, O.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

August C. Christensen, 24 State st., N. Y., Consulting Engineer. Designs of all kinds of Machinery.

Turned and Highly Polished Iron and Steel Shafting a specialty. Merwin McKaig, Cumberland, Md.

Model Engine Castings for sale. Send for circular. Lowell Model Co., 170 Merrimack st., Lowell, Mass.

Schmidt & Co., 23 Centre st., N. Y., Consulting Engineers. Machinery designed, power measured.

Designs and working drawings for special machinery, tools, etc. attended to by experienced draftsman. "Draftsman," Box 107, AM. MACHINIST.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Wanted—To buy second-hand lathes, planers and shapers of all sizes; must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

The subscriber would like to correspond with party having a good mechanical novelty, with a view to purchasing the patent or manufacturing on royalty; something in machinists' tool line preferred. Address Manufacturer, care AMERICAN MACHINIST.

A practical business man wishes to arrange with some good firm of engineers to manufacture a patent engine, especially adapted for marine use. An engine of 40 H. P., now on exhibition at the Paris Exposition; New York city or vicinity preferred; references given and required. Address John H. Blake, Batavia, N. Y.

Established 1832. BRADLEY'S POWER HAMMERS
The BEST in the WORLD
RUN BY BELT.
Over 1500 in USE
BRADLEY'S HEATING FORGES
Indispensable in all shops to keep
BRADLEY'S CUSHIONED HAMMERS
and men fully employed and reduce the cost of production.
BRADLEY & CO. SYRACUSE, N.Y.
63 Murray st. NEW YORK; 98 Sudbury st. BOSTON, MASS.

SOLID EMERY OIL STONES AND Triple Coated KNIFE SHARPENER
WHOLESALE ONLY BY THE TANITE CO. STROUDSBURG PA.

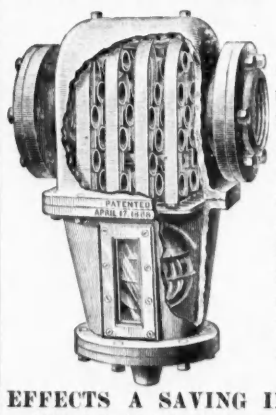
JONES & ROGERS,
5 West 4th St., Cincinnati, O.,
CONSULTING ENGINEERS AND BLUE PRINTERS.
Machines Designed and Working Drawings Made.
We never sleep. WRITE FOR ESTIMATES.

$75
"Star" Foot Lathe Swings 9x25 in.
LATHE
Screw Cutting Automatic Cross Feed, etc.
Scroll Saws, Circular Saws, Lathes Mortisers.
Catalogue Free of all our Machinery.
Seneca Falls Mfg. Co. 687 Water St., Seneca Falls, N.Y.

OUR NEW CATALOGUE OF TOOLS
And Supplies sent free to any address on receipt of Ten Cents in stamps (for postage).
Chas. A. Strelinger & Co., WOOD AVE. Detroit, Mich.

PATENT FOR SALE. Automatic slack adjuster for Car Brakes, in successful operation two years. C. & C., care AMERICAN MACHINIST.

AUTOMATIC GREASE EXTRACTOR.



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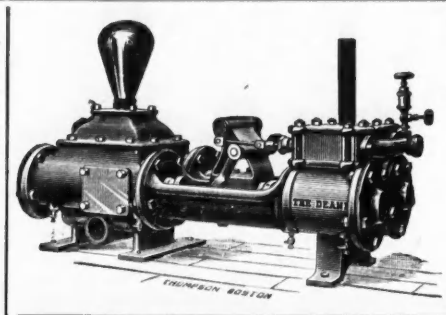

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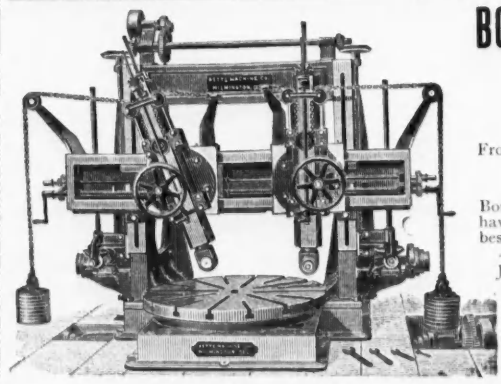

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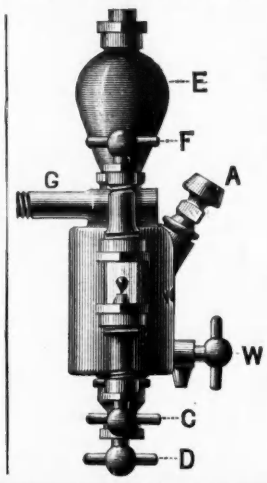

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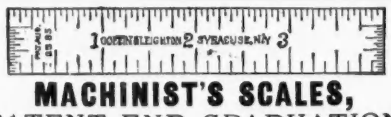

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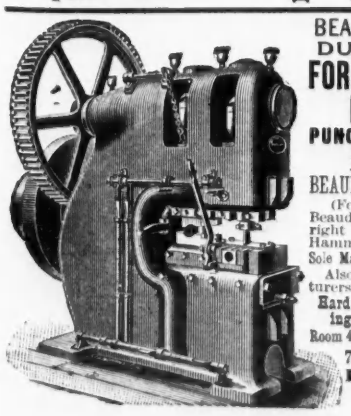

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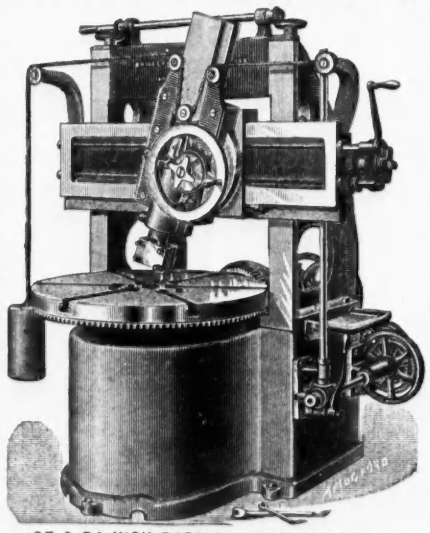

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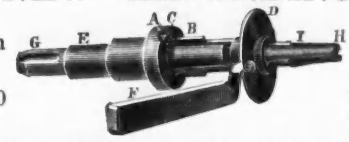

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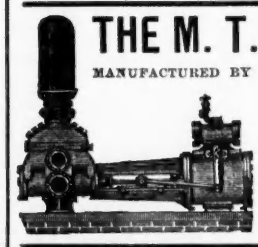

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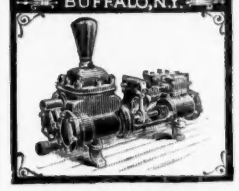

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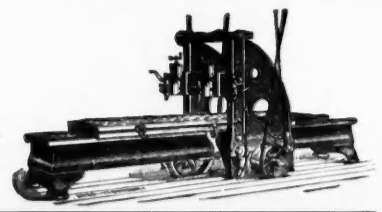

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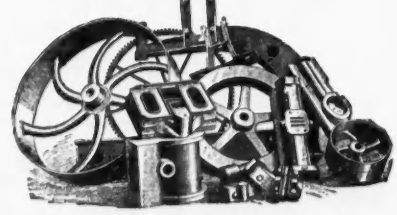

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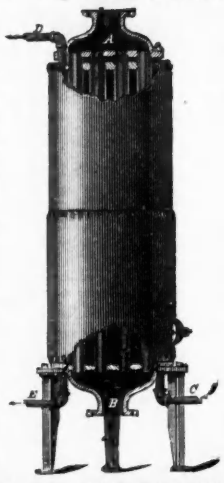

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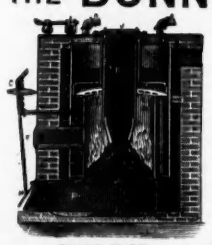

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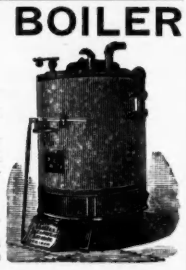

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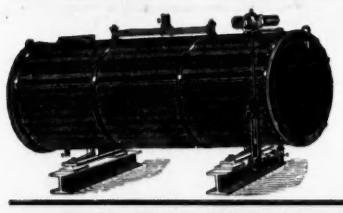

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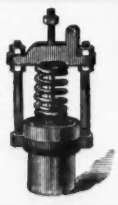

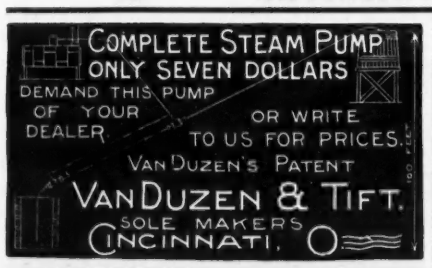

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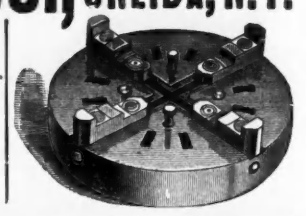
Jaws Reversible.

Diameter.	Capacity.
5 inch.	5 inch.
7½ "	7¾ "
10⅛ "	10¼ "
13 "	13⅛ "
15¼ "	17 "
18 "	19¾ "
21 "	25½ "
24 "	28 "



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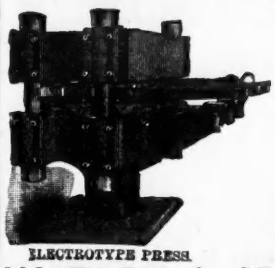

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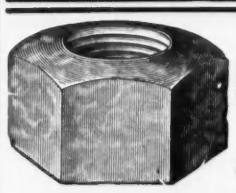

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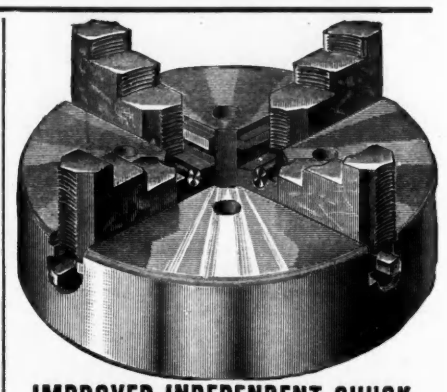

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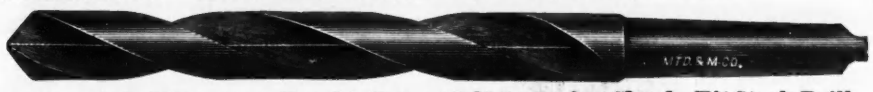

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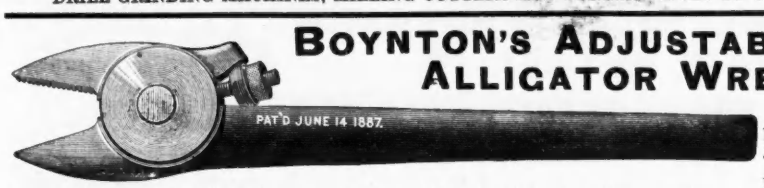

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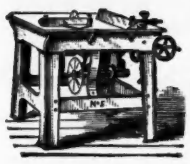

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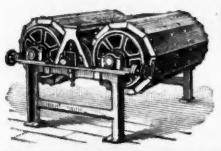

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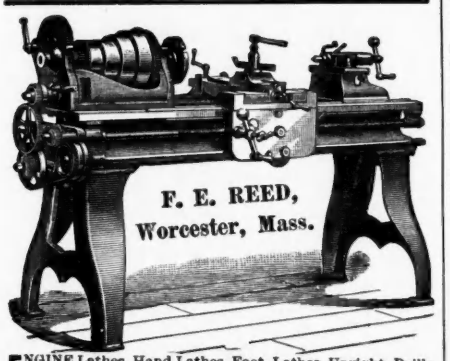

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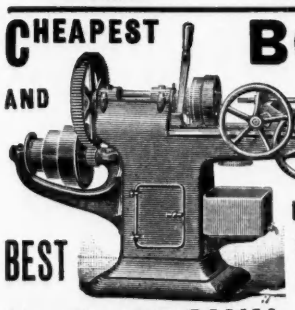

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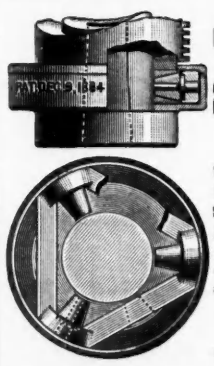

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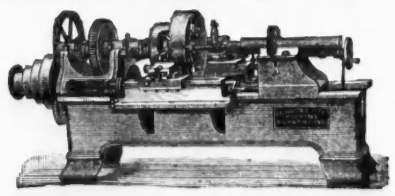

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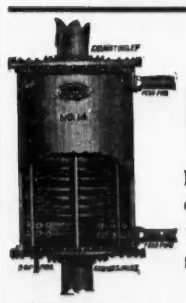

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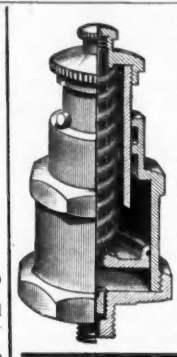

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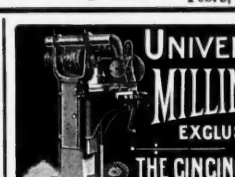

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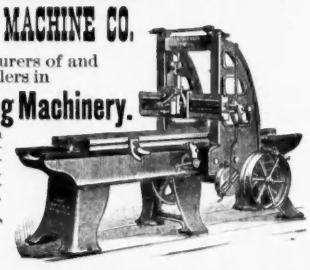

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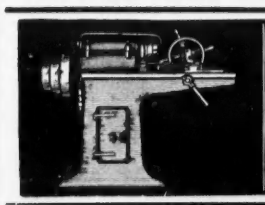

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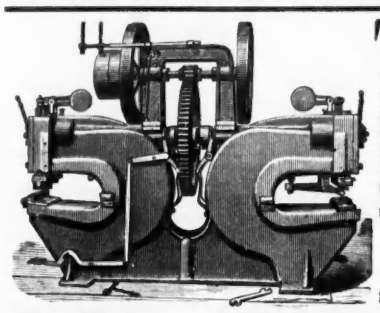

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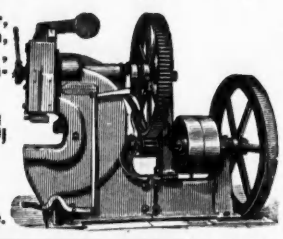

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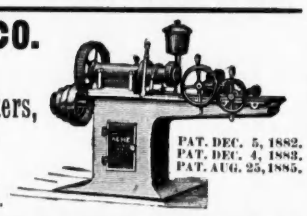
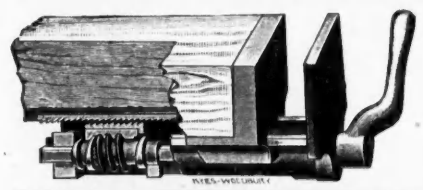


PAT. DEC. 5, 1882.
PAT. DEC. 4, 1883.
PAT. AUG. 25, 1885.



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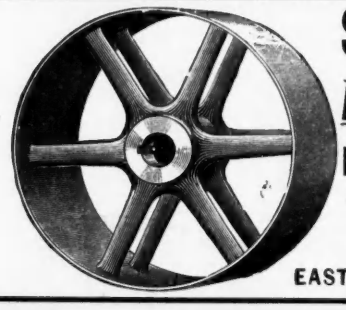

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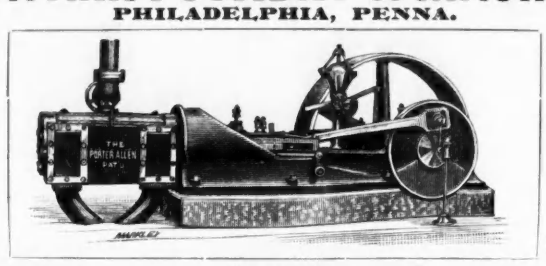

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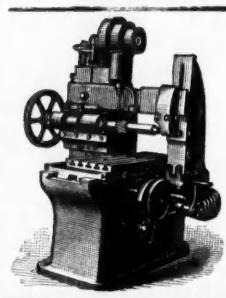

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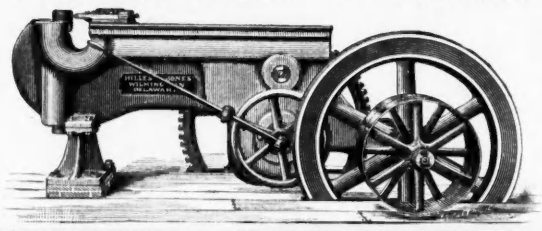

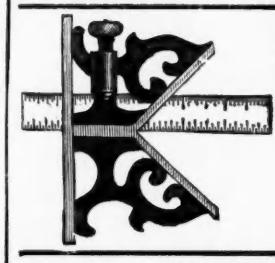

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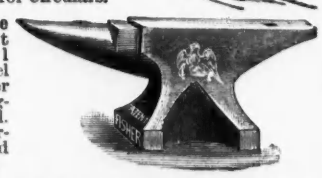

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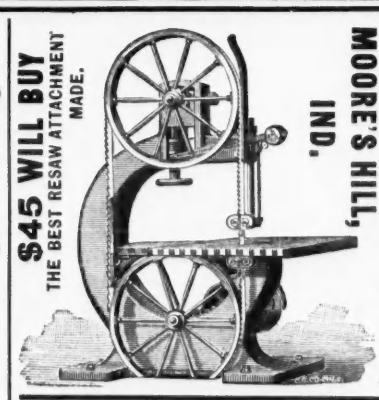

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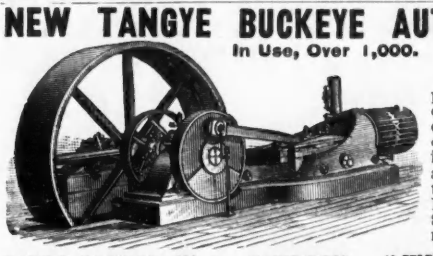

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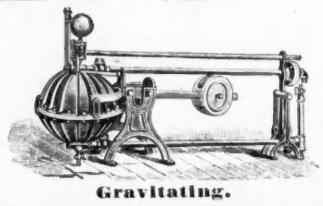

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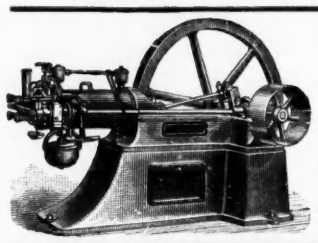

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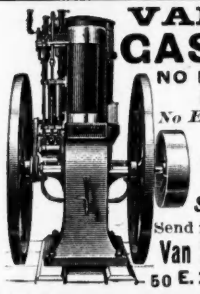

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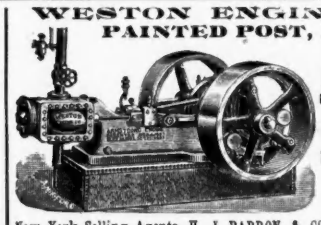

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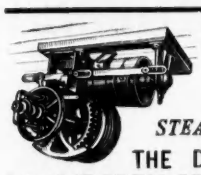

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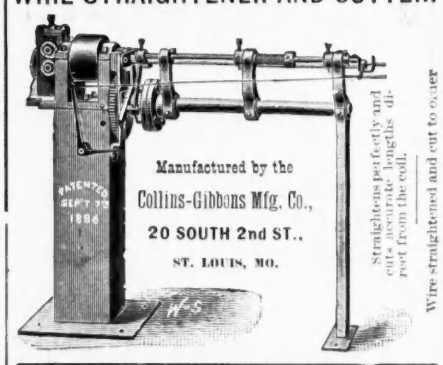
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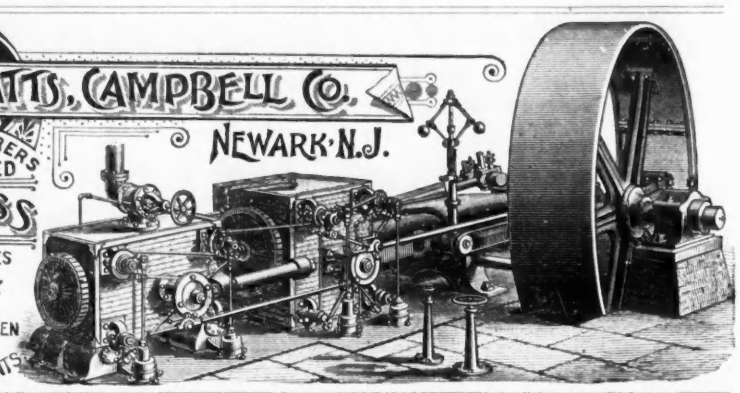

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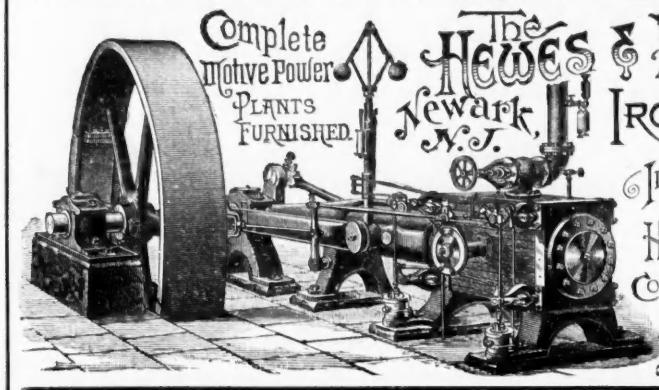

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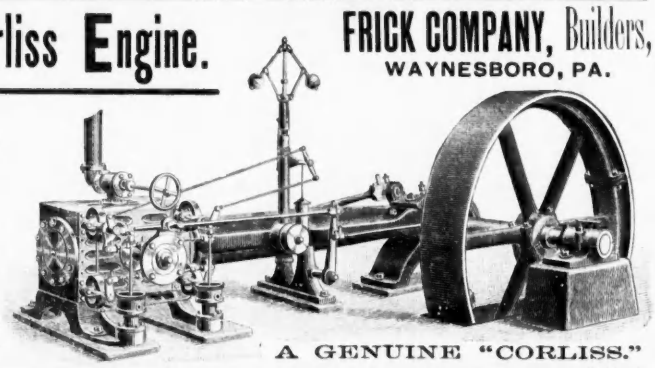

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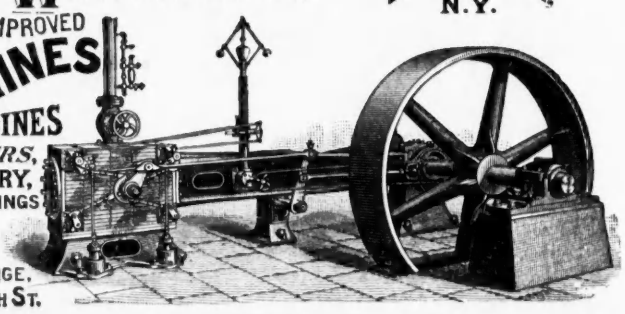

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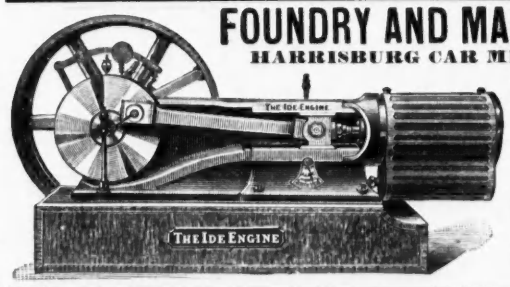

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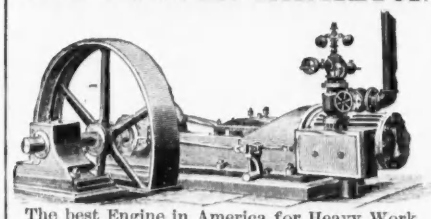

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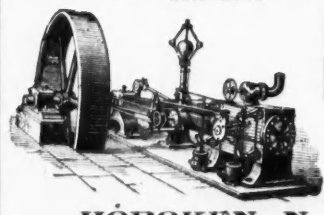

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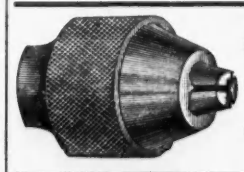

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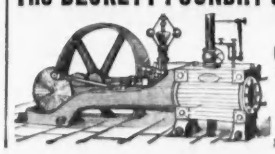

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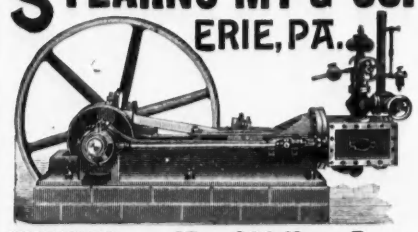

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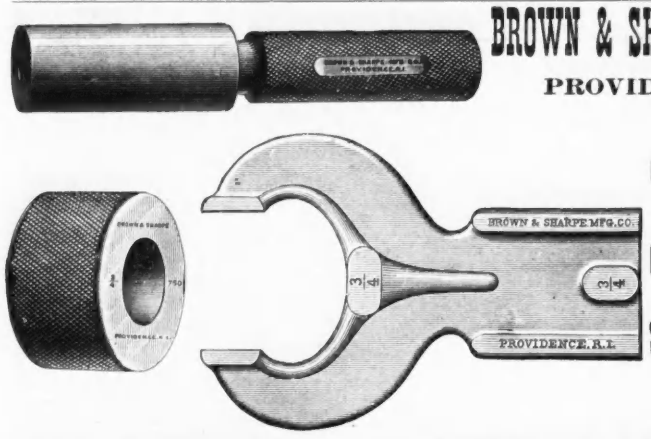

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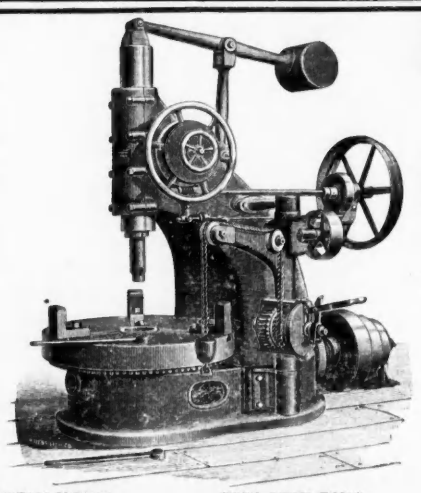

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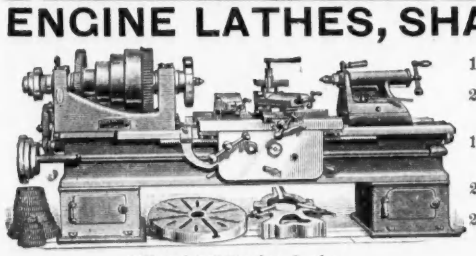
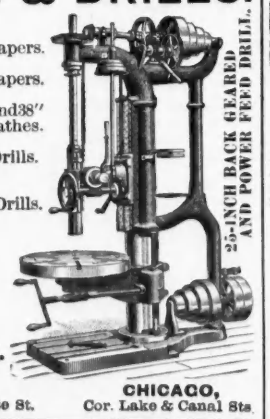
ENGINE LATHES, SHAPERS & DRILLS.



24" and 27" Engine Lathe.

15" and 20" Crank Shapers.
20" 26" and 32" Geared Shapers.
17" 19" 21" 24" 27" and 38" Engine Lathes.
20" 24" Upright Drills.
25" 28" 32" 40" B. G. P. F. Drills.



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See advertisement, page 15.

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Near Market St. Depot,
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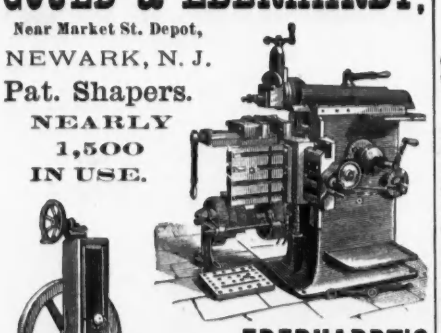
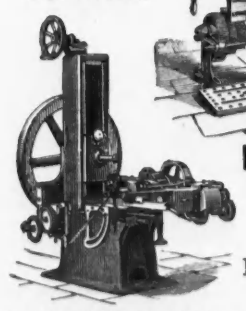
NEARLY 1,500 IN USE.





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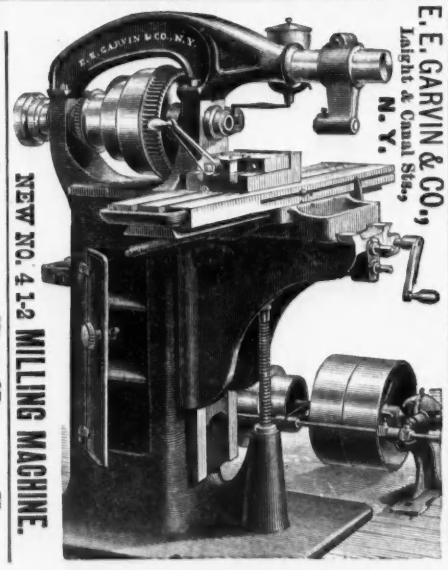
In Use throughout the World.

GEAR AND RACK CUTTING TO ORDER.



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E. E. GARVIN & CO., Laight & Canal Sts., N. Y.

THE PRATT & WHITNEY COMPANY,

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MANUFACTURE

PLANERS

To plane 16 in. x 16 in. x 3 ft., to 60 in. x 60 in. x 20 ft., with quick return motion.

PILLAR + SHAPERS

With 6 in. x 10 in. stroke.

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With 12 in. and 14 in. stroke, all feeds automatic.

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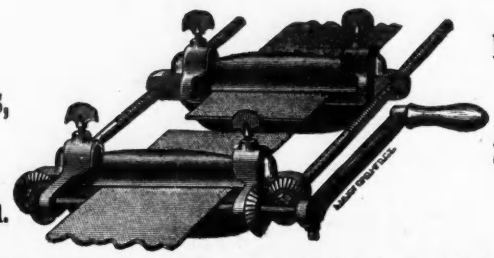

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Formerly of Worcester, Mass.

The new shops of this company are located at Plainfield, N. J., forty minutes' ride from New York city on the line of the Central Railroad of N. J., and consist of the following:

A machine shop 500' long by 100' wide; a foundry 250' long by 90' wide; also commodious buildings for the storage of sand, coal, coke and pig iron; ample and convenient wash rooms for the men; fire-proof two-story pattern storage; blacksmith shop; engine and boiler houses. These buildings are detached from the machine shop and foundry. There is an elevated railroad for the convenient distribution of raw materials, and a railroad running through the machine shop for shipping. The whole plant is supplied with the incandescent system of electric lighting.

The machine shop and foundry have overhead traveling cranes running through their entire lengths; also light traveling cranes, which serve every tool, and a number of jib cranes in the foundry and scratch rooms. The foundry has capacity for making the heaviest class of castings.

All our tools are expressly designed for the economical manufacture of heavy machinery for railroad and general machine shop equipment, from new patterns of the latest and best designs.

SALESROOM and OFFICE, 111 & 113 Liberty St., N. Y. City.
NEW SHOPS, Plainfield, N. J.

GEO. W. FIELD,

Manufacturer of ENGINE LATHES from 16 to 48 in. swing. Cuts, Photographs and Prices furnished on application.
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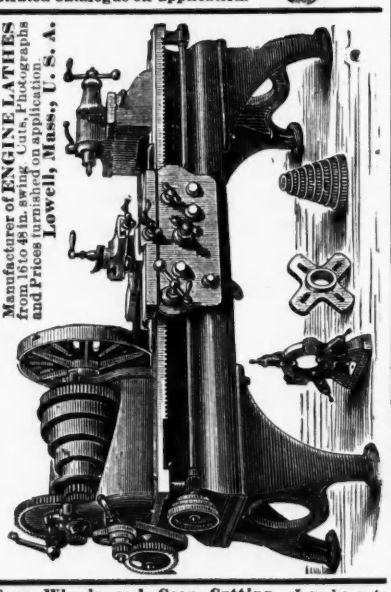

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Key-Seating Machines and 20 in. Drills

A SPECIALTY.
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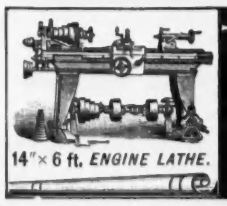


14" × 6 ft. ENGINE LATHE.

The Hendey Machine Co.

IRON & BRASS WORKING MACHINE TOOLS
TORRINGTON CONN.
SEND FOR OUR CATALOGUE

J. M. CARPENTER
PAWTUCKET, R. I.

Manufacturer —of— TAPS & DIES

great deal, especially if all captains are like Captain Lewis, of the "City of Berlin," whose efforts towards the comfort and pleasure of his passengers are unlimited, and whose seamanship and ability are unquestionable.

But incessant care cannot prevent the machinery of a steamship from breaking down at sea. It will sometimes let go without warning, then the mechanical skill and ingenuity of the engineer is of special service. On a recent voyage the piston valve of the high-pressure cylinder of the "City of Berlin" broke. The valve was disconnected and removed, but pieces of the packing were missing, and as these might get into the ports of the intermediate cylinder, and disable its valve, they were searched for, and finally so far collected that it was thought safe to proceed. The high-pressure piston was not removed or disconnected, the steam passing through this cylinder to the valve casing of the intermediate cylinder, the engine working the remainder of the voyage as a two-cylinder compound, and under reduced steam pressure. In a short time after the accident the ship was steaming along at fifty-four turns of the shaft, dragging the high-pressure piston—now useless for the time—through its usual journey back and forth.

Many are the instances in which the engines of a steamship have, apparently, been quite disabled at sea, but the engineer has contrived to bring her in under steam. In triple expansion engines, if the shaft holds together, it is generally possible to work two, or at least one of the cylinders.

I have had occasion to speak frequently of Chief Engineer Campbell, whom I found as courteous as a gentleman as he is able as an engineer. I am indebted to him for every opportunity for observation, and for any information asked for. He is a veteran in the business, having been with the Inman Company more than thirty years—and his first work was not with that company. In going around with him amongst the machinery, it appeared to me that his eye missed nothing, and a quiet hint here and there called more than one man's attention to some trifling matter that required attention. The way in which the machinery of the "City of Berlin" does its work is all any one acquainted with mechanical matters would care to know about his ability as an engineer. In the voyage from New York to Liverpool his engine made about 800,000 revolutions, and the last thousand were made just as quietly as the first.

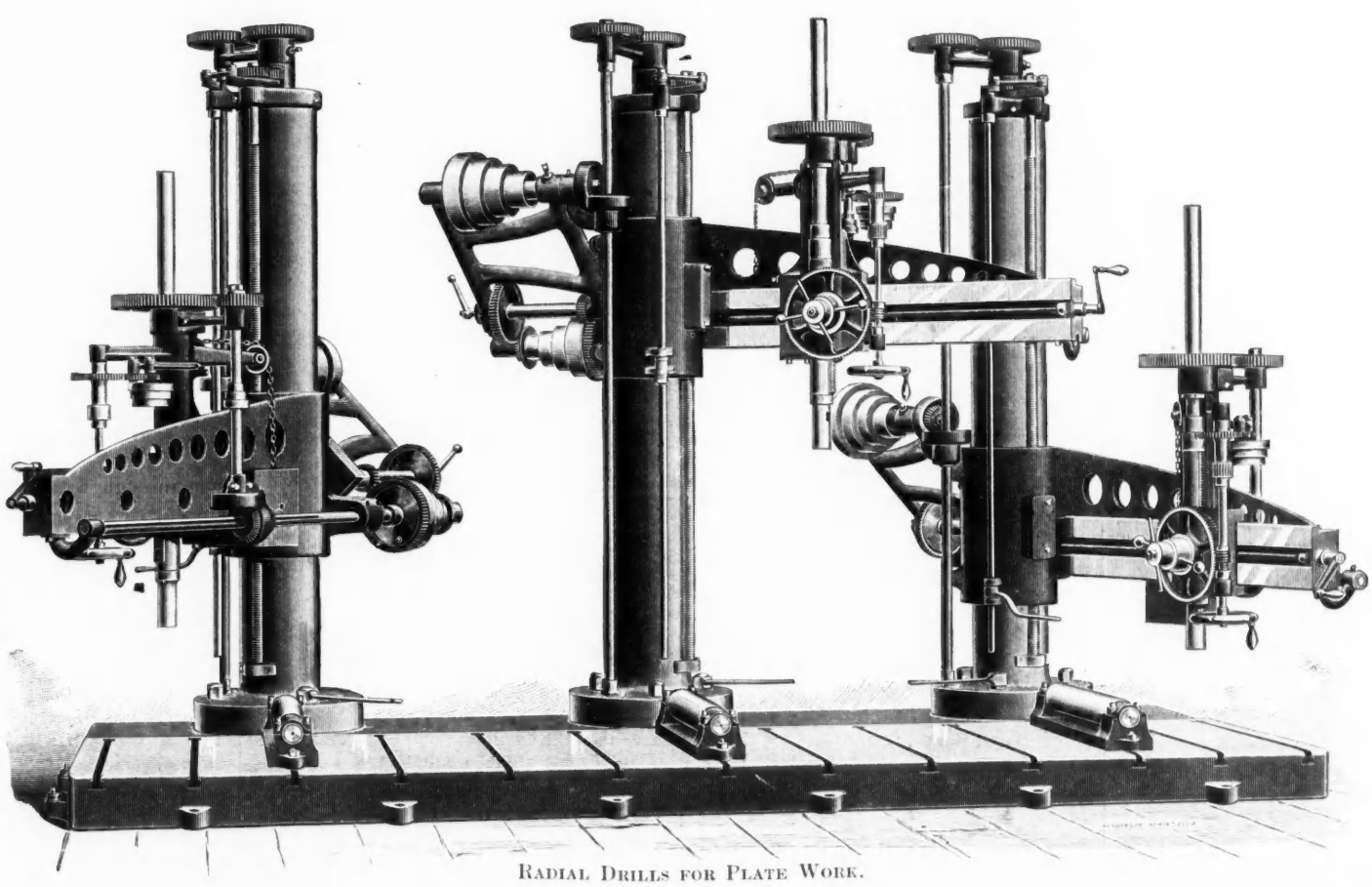
I have spoken of the present engine being nearly new. It replaced a two-cylinder compound, which required four more boilers than are now used. But there is no ground for comparison here, since the new boilers carry higher steam pressure, which is a potent factor in economy of fuel. The present boilers are licensed in New York for 150 lbs. pressure, and they generally get it. The old ones carried, I believe, 80 lbs., so it is not possible to say how much of the saving in boiler capacity is due to triple expansion, and how much to high steam pressure. Perhaps triple expansion would have been no advantage with the lower pressure, and two-cylinder compound might have been at a disadvantage with the higher pressure, although this is not probable.

The engine usually indicates, under regular working conditions, from 5,500 to 5,700 horse-power—but is capable of doing 7,000 horse-power. Making an allowance that appears to be about right for the coal required for pumps and auxiliary engines—$1\frac{1}{2}$ lb. of coal per I. H. P. per hour is required with greater boiler capacity, so as to permit easier firing—the consumption of coal would undoubtedly be reduced.

The cut-off is at about 3 feet 6 inches in the high-pressure cylinder, some 4 inches later in the intermediate, and 4 inches later in the low-pressure cylinder than in the intermediate.

About 30 lbs. of coal are burned per hour per square foot of grate, giving about 17 horse-power; a little more than three knots are made for each ton of coal burned. Keeping within the limits of easy fractions, it takes $2\frac{4}{10}$ lbs. of coal to give one revolution to the shaft—each revolution advancing the ship on her journey nearly 20 feet.

H.



RADIAL DRILLS FOR PLATE WORK.

Foundry Ladle and Carriage.

BY ROBERT E. MASTERS.

Fig. 1 (page 2) is a plan view of a large ladle and carriage. There are two views at Fig. 2; the right-hand half of the drawing is a side elevation, and the left hand portion is a sectional view through the center of ladle and carriage.

The bed-plate or frame *A A*, in Figs. 1 and 2, is cast in one piece; it is 6′ 5″ long, 3′ 2″ wide, 12″ deep at the sides and ends, and $1\frac{1}{4}$″ thick. *B* shows the shape of the ends of the frame. The axle-boxes *C* are cast on the frame wide enough for a good bearing, and from the top of the box *D* they taper off to the thickness of the side of the frame at *E*. *G* is the journal brass, and the dotted line *H* shows the oil cellar. The axles are $2\frac{3}{4}$″ round iron. *I I* are single plate chilled car wheels, 20″ diameter and 4″ face, gauge 3′ $7\frac{1}{2}$″.

The uprights *J J* to support the ladle are 24″ high from carriage frame to bottom of bearing, and taper from 18″ wide at base to 11″ at the top; they are box shape and $1\frac{1}{4}$″ thick. The front standard has bearings on it for the worm and pinion shaft *K*. The crank shaft standard *L* is cast in one solid piece, and bored through the end for the wrought end of the crank to go through to key the miter pinion on; the standard is bolted to the bed, and is 11″ high, to the center of bearing. The 24″ gear *M* is keyed on the end of the ladle trunnion.

The band *N* around the ladle is 4″ wide by $1\frac{1}{2}$″ thick; over this the trunnion plates *P* fit. These plates are 17″ wide, 17″ long and $1\frac{1}{2}$″ thick. The trunnions *R* are 6″ diameter at plate, and 4″ diameter in bearings; plates and trunnions in one piece.

The wrought-iron strap to support the bottom of ladle is 2″ wide and $1\frac{1}{4}$″ thick in the rings *S S* where it fits around trunnions, and 3″ wide by 1″ thick at the sides, and forming an oval underneath the ladle.

The ladle is made of $\frac{3}{8}$″ iron. The inside dimensions of shell are: Bottom diameter, $44\frac{1}{2}$″; top diameter, $50\frac{1}{4}$″; height, $50\frac{1}{4}$″. Lined up with fire-brick and clay, $3\frac{1}{2}$″ thick in the bottom, and $2\frac{1}{2}$″ at the sides; this ladle will hold 16,000 pounds, and leave 3″ room from the iron to the edge of the ladle, this for the sway and motion of the iron, and for safety.

T is a wrought-iron eye-bolt in front of carriage; there is also an eye-bolt fastened to the carriage at *V*, extending clear over the wheels. A chain fastened into the eye-bolt *V* goes through a chain sheave that is fastened back at the cupola; the chain then extends to and around drums in a stationary frame that are at the opposite side of the shop, and then continues, and is fastened to the eye-bolt *T*. The ladle is hauled back and forth across the shop by a power rigging at the drum, on the same plan as is used to operate a planer bed.

This ladle is used in a car wheel foundry, and receives the iron from a large Colliau cupola, and is kept as near full as possible during the whole heat. The wheel floors are straight, and have overhead tracks and traveling cranes. The ladle is hauled on the track which crosses the foundry at the end of the wheel floors, the wheel ladles are filled from it, and the large ladle hauled back under the cupola spout. A few open links are kept handy in case the chain breaks. The carriage moves at a very good speed, and does not pull as heavy as one would think; I have seen four men pull the ladle across the shop when it was full, by giving it a little start with a pinch bar.

Of course it would be unfair to presume that the *Manufacturers' Gazette* of Boston has no one on its editorial staff who knows anything of mechanics or engineering matters; but it is quite evident that the engineering editor must have been absent recently, for a time at least, the evidence of this appearing in an editorial article, in the issue of June 22, commenting upon the new steam storage scheme to which we alluded last week. This editorial resembles very much those relating to mechanical matters often found in the daily newspapers, and, it is apparent, was written by some one having a very sad lack of familiarity with the subjects about which he was writing. He seems to assume that steam has, until recently, been in great danger of being superseded by electricity, because, until electricity appeared, steam "had no rival, no competitor, and on this account has not, according to many authorities, advanced in the line of perfection in the same proportion that other branches of science, pushed by competitors to more economical and improved methods, have done." Now that electricity has so nearly driven steam out of use, the steam men have at last been roused from their lethargy, and the result is steam storage, with which electricity cannot hope to compete, provided cheap fuel can be obtained. All this is, of course, absurd, and only serves to emphasize the necessity for constantly keeping some one around the office of a journal circulating among manufacturers who knows something of engineering, or else carefully steering clear of such subjects.

Radial Drills for Plate Work.

With this we present an illustration showing an arrangement of radial drills specially adapted to heavy plate work, this machine having been built by the Cincinnati Universal Drill Co., for the Portsmouth, Va., Navy Yard. The drills themselves, having been recently described in our columns, need no description at this time. They are attached to the heavy bed plate by means of rigidly attached stumps over which the columns fit, and are so placed that any part of a sheet may be reached by one or more spindles, and all three may be in operation simultaneously.

The rollers, one of which is shown in front of each column, are intended to facilitate the handling of heavy sheets or beams, and may be placed in any desired position on the bed, or readily removed altogether.

Separate countershafts are furnished for each machine, so that the movements of each are entirely independent of the others. Though intended primarily for plate work, it is obvious that the arrangement may be used for other forms of heavy work where it is desirable to drill several holes simultaneously.

It seems to be the general verdict of visitors to the Paris Exposition that America has not made very good use of her opportunities, so far as securing a creditable general display is concerned, but that our machinery interests are best represented. It is also declared that the credit for much of the machinery exhibited by other countries belongs to America.